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[Grass and Forage Plant Investigations.]

AMERICAN GRASSES—III.

(ILLUSTRATED.)

DESCRIPTIONS OF THE TRIBES AND GENERA.

BY

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U. S. DEPARTMENT OF AGRICULTURE,
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Washington, D. C., January 12, 1900.

SIR: I transmit herewith and recommend for publication descriptions and analytical keys of the tribes and genera of North American Grasses. Each genus is illustrated, and reference is made to all other species of the genus illustrated in Bulletins Nos. 7 and 17 of this Division. There is added a bibliography of all the authors cited in these bulletins. This bibliography will be of great assistance to the working student, and the analytical keys will be helpful in identifying our American Grasses.

A portion of the matter here offered was published in the introduction to Bulletin No. 7, and although it may still serve as an introduction to the study of American Grasses it has been deemed best to issue it in its present expanded form as a separate publication. It is in a measure complete in itself, and will be as useful to those who have already received Bulletins Nos. 7 and 17 as to those who may receive copies of future editions of American Grasses, Illustrated.

Respectfully,

F. LAMSON-SCRIBNER,
Agrostologist.

Hon. JAMES WILSON,
Secretary of Agriculture.

DESCRIPTIONS

OF THE

TRIBES AND GENERA.

DESCRIPTIONS OF THE TRIBES AND GENERA.

As an introduction to the series of illustrations which appear in American Grasses, a description of the several tribes and genera into which the order *Gramineae* is divided is here presented. The number and sequence of the tribes adopted by Hackel has been followed and with few exceptions the same is true of the genera. It has been aptly stated that the secret of success in the discrimination of grasses lies in being thoroughly conversant with the tribal and generic characters. The acquisiton of this knowledge is not difficult, and, when mastered, enables one to classify or to refer to its proper tribe and genus any grass he may meet—a power which adds greatly to the interest connected with the study of all plants. It is hoped that the matter here presented will at least assist the student of grasses in becoming better acquainted with the most important of all the orders in the vegetable kingdom—the true grasses.

GRAMINEÆ (GRASSES).

Fibrous-rooted, annual or perennial, herbaceous (rarely woody) plants, with usually hollow, cylindrical (rarely flattened), and jointed stems (*culms*) whose internodes for more or less of their length are enveloped by the sheath-like basal portion of the two-ranked and usually linear, parallel-veined leaves; flowers without any distinct perianth, hermaphrodite or rarely unisexual, solitary or several together, in *spikelets*, which are arranged in panicles, racemes, or spikes, and which consist of a shortened axis (the *rachilla*) and two or more chaff-like, distichous, imbricated bracts (*glumes*), of which the first two, rarely one or none or more than two, are empty (*empty glumes*); in the axil of each of the succeeding bracts (excepting sometimes the uppermost) is borne a flower

(hence these are named *flowering glumes*). Opposed to each flowering glume, with its back turned toward the rachilla, is (usually) a two-nerved, two-keeled bract or prophyllum (the *palea*), which frequently envelops the flower by its infolded edges. At the base of the flower, between it and its glume, are usually two very small hyaline scales (*lodicules*); rarely there is a third lodicule between the flower and the palea; stamens, usually three (rarely two or one, or more than three) with very slender filaments and two-celled, usually versatile anthers; pistil with a one-celled, one-ovuled ovary, and one to three, usually two, styles with variously branched, most frequently plumose, stigmas; embryo small, lying at the front and base of the seed, covered only by the thin pericarp; fruit a caryopsis, rich in albumen. (In *Sporobolus* and *Eleusine* the thin pericarp is free from the seed.)

There are about thirty-five hundred known species of grasses, varying in size from the moss-like *Coleanthus* of the North to the tree-like bamboos of the Tropics, which tower to the height of 100 feet or more, and ranging in distribution from Kerguelen Land on the south to the extreme limit of vegetation beyond the Arctic Circle. There is no order of plants more widely distributed, or existing under a greater diversity of soil and climate, and no other order presents such a vast number of individual plants or is so important and directly useful to man.

The characters employed in defining the tribes and genera are usually those presented by the spikelets or inflorescence. While the characters of the order are well defined and clearly separate it from all other families of plants, the establishment of the several subdivisions is very difficult, and in no case can be based upon a single character alone, but upon a combination of them. There is no tribe or large genus which can be separated or defined absolutely from all others; there are always exceptions or intermediate forms connecting them.

Series A.—PANICACEÆ.

Spikelets one rarely two-flowered; when two-flowered the second or terminal one is perfect, the first or lower one being either staminate or neuter; rachilla articu-

lated below the empty glumes, the spikelets falling from the pedicels entire, either singly, in groups, or together with the joints of an articulate rachis. The first six tribes belong to this series.

This first grand division of the order Gramineæ is based upon two characters in combination, the articulation of the pedicels just below the spikelets or cluster of spikelets and the single perfect flower, which may or may not have a staminate or imperfect flower below it. There are never more than four glumes in the spikelets, the first three being empty or the third with a rudimentary or staminate flower in its axil; the fourth glume subtends the perfect or hermaphrodite flower. In a few genera the spikelets are reduced to two or even only one glume, but in these cases the articulation of the spikelet with the pedicel below the outer glume indicates its connection with this series.

KEY TO THE TRIBES IN SERIES PANICACEÆ.

1. Spikelets usually much compressed laterally, 1-flowered; empty glumes none or rudimentary; flowers staminate, pistillate, or hermaphrodite..... Tribe VI. ORYZEÆ. (See page 43.)
1. Spikelets not compressed laterally, somewhat dorsally compressed or terete; empty glumes two or three (one only in *Reimaria*) 2

2. Flowering glumes hyaline, empty glumes membranaceous to coriaceous, the lowest the largest, its edges embracing the others; axis of the inflorescence usually articulated (continuous in *Imperata* and *Miscanthus*) 3
2. Flowering glumes membranaceous to coriaceous, usually firmer in texture than the empty glumes, axis of the inflorescence continuous, not breaking up at maturity 4

3. Spikelets either staminate or pistillate, each in a separate inflorescence on the same plant, or in distinct parts of the same inflorescence ..... Tribe I. MAYDEÆ. (See page 10.)
3. Spikelets either all hermaphrodite or hermaphrodite and staminate, regularly arranged and usually in pairs, one sessile the other pedicellate in the same inflorescence (both pedicellate in *Trachypogon*) .. Tribe II. ANDROPOGONEÆ. (See page 15.)

4. Spikelets in groups of two to six at each point of the main axis, each group falling off entire; flowering glumes usually awnless. (*Cathestecum* may be looked for here.)
Tribe III. OSTERDAMIEÆ. (See page 25.)
4. Spikelets falling off singly from the ultimate branches of the inflorescence..... 5

5. Flowering glumes of the perfect flower membranaceous and (in American species) awned.
Tribe IV. TRISTEGINEÆ. (See page 30.)
5. Flowering glumes of the perfect flower cartilaginous, coriaceous or chartaceous and awnless or (in *Eriochloa*) with a short, straight awn ..... Tribe V. PANICEÆ. (See page 30.)

TRIBE I.—MAYDEÆ.

Spikelets unisexual, the staminate forming a part of the inflorescence with the pistillate, or each in a separate inflorescence on the same plant; flowering glumes hyaline or much less firm in texture than the outer ones; axis of the female spikelet usually articulated.

A small tribe, numbering only sixteen species classed in seven genera. They are nearly all natives of the Tropics, chiefly in the Old World. Indian corn, or maize, is our best-known example of the Maydeæ.

KEY TO THE GENERA OF THE MAYDEÆ.

1. Staminate spikelets in an upper, pistillate in a lower and distinct inflorescence..... 2
1. Staminate spikelets above, the pistillate below in the same inflorescence ..... 3. TRIPSACUM

2. Pistillate spikes many-flowered, enveloped in broad, leaf-like bracts; the staminate spikes numerous in terminal panicles 3
2. Pistillate spikes usually reduced to a single spikelet, staminate spikes solitary ..... 4. COIX

3. Pistillate spikes axillary, fasciculate, distinct, axis of each articulate ..... 1. EUCHLÆNA
3. Pistillate spikes axillary, grown together, forming a compound spike with a much thickened, continuous axis..... 2 ZEA

FIG. 1. **Euchlæna mexicana** Schrad. TEOSINTE.—*a*, A pistillate spike with one of the surrounding sheath-like bracts; *b*, a portion of the pistillate spike, natural size.

1. **EUCHLÆNA** Schrad. Ind. Sem. Hort. Gœtt. 1832. Spikelets unisexual, monœcious; the staminate 2-flowered, in pairs, one sessile the other pedicellate, arranged in terminal paniculate racemes; the pistillate 1-flowered, sessile and solitary at each joint of an obliquely articulate rhachis of a simple spike; the spikes fasciculate in the leaf axils and each more or less enveloped by a foliaceous bract. Glumes of the staminate spikelets 4, acute, the first two membranaceous, empty; flowering glumes smaller and like their paleas, hyaline. Stamens 3. Glumes of the pistillate spikelets 4, the outer one broad and boat-shaped, smooth, soon becoming very hard, surrounding the inner glumes and narrow rhachis, 2d glume empty coriaceous, 3d glume hyaline with a palea but no flower; 4th or flowering glume and its palea hyaline. Styles very long, filiform, shortly bifid at the apex.

Tall annuals with long and broad leaves, closely resembling Indian corn in habit. Species 1 with several varieties in Mexico and Central America.

FIG. 2. **Zea mays** Linn. INDIAN CORN.—*a*, A pistillate spikelet; *b*, a pair of staminate spikelets; *c*, the compound pistillate spike or "ear;" *d*, pistil.

2. **ZEA**, Linn. Sp. Pl. 971. 1753. Spikelets unisexual, monœcious; the staminate 2-flowered in pairs, one sessile the other pedicellate, along the numerous branches of a terminal panicle; the pistillate 1-flowered, sessile, crowded in several rows, along a much thickened continuous axis arising from the lower leaf-axils and closely enveloped by numerous large foliaceous bracts. Glumes 4, awnless; those of the staminate spikelet acute; those of the pistillate very broad and obtuse or emarginate. Grain hard, only partially inclosed by the fruiting glumes. A well-known tall and striking annual grass with erect stems and broad leaves. The terminal staminate inflorescence forms the "spindle," and the long projecting styles of the pistillate flowers constitute the "silk." The cob is formed by the union of the axes of several female spikes into a much-thickened body.

Species 1 or 2, of American origin, presenting many varieties in cultivation known as corn, indian corn or maize.

FIG. 3. **Tripsacum dactyloides L.** GAMA GRASS.—*a*, Two joints of the pistillate portion of the spike; *b*, a pistillate spikelet; *c*, outer glume of same; *d*, second glume of same; *e*, flowering glume and palea showing the long exserted stigmas; *f*, staminate spikelet.

3. **TRIPSACUM** Linn. Syst. Nat. Ed. 10, **2**: 1261. 1759. Spikelets unisexual, all sessile; the 2-flowered staminate spikelets geminate along the continuous rachis above; the 1-flowered pistillate spikelets solitary at each joint of the articulate rachis below in the same spicate inflorescence, which terminates the culm or its branches. Glumes 4, awnless, the 2 lower or outer ones in the male spikelet empty and rigid or subcoriaceous, those inclosing the male flowers hyaline; the 1st glume of the female spikelet coriaceous, and at length indurated; the 2d rigid; the 3d empty, but hyaline like the 4th, which incloses the female flower. Stamens 3. Styles connate below with long exserted papillose stigmas. Grain ovoid, inclosed within the excavations of the thickened joints of the rachis and covered by the hardened lower glumes, free. Tall, stout, perennial grasses, with abundant and broad lower leaves and strong rootstock.

Species 3 or 4, in North America.

FIG. 4. **Coix lachryma**—jobi Linn., JOB'S TEARS.—*a*, A pair of staminate spikelets; *b*, ovary; *c*, pistil, with the rudimentary stamens.

4. **COIX**, Linn. Gen. Pl., Ed. 1, No. 704. 1737; Ed. 6, No. 1043. 1764.—Spikelets unisexual, monœcious, spicate. Staminate spikelets in twos or threes at the joints of the rachis, 1-2-flowered. Empty glumes slightly unequal, rigid or herbaceous, inclosing the hyaline flowering glumes and palea. Stamens, 3. Pistil, none. Pistillate spikelets, 1 or 2 at the base of the inflorescence, inclosed or surrounded by a nearly glabrous capsule-like covering, from the apex of which the staminate inflorescence projects; glumes thin-membranaceous or subhyaline. Styles very long. Stigmas distinct, with short, papillose-villous hairs. Grain glabrous or oblong, closely embraced within the hardened covering inclosing the pistillate spikelets. Tall, leafy, and much branched grasses, usually with many pedunculate spikes from the upper leaf-sheaths.

Species 3 or 4; three confined to the East Indies, the fourth is widely distributed throughout the tropical countries of both hemispheres.

Tribe II.—ANDROPOGONEÆ.

Spikelets in spike-like racemes, two at each joint of the articulate rachis, one sessile and hermaphrodite, one pedicellate, the latter hermaphrodite, staminate, neuter, or reduced to the pedicel alone: glumes usually four, the first and second empty, larger and much firmer in texture than the others, the third usually empty, with a staminate flower in its axil, very rarely awned, the fourth or flowering glume hyaline, usually awned, awn usually twisted or geniculate.

This tribe contains about four hundred species, divided among twenty-nine genera, of which the genus *Andropogon*, with one hundred and ninety species, is by far the largest and probably the most important. Sugar-cane belongs to this tribe in the genus *Saccharum*. Our best-known representatives of the Andropogoneæ are the common broom sedge, *Andropogon virginicus*, and the big blue stem, *Andropogon provincialis*. In the same genus are now classed the many varieties of sorghum. The members of the tribe are distributed throughout the tropical and warmer temperate regions of both hemispheres.

KEY TO THE GENERA OF THE ANDROPOGONEÆ.

1. Axis of the spikes or racemes hairy; fertile glumes usually awned 2
1. Axis of the spikes or racemes naked; fertile glumes awnless .. 6
2. Spikelets all alike (homogamous) 3
2. Spikelets not all alike (heterogamous) 7
3. Floral axis continuous 4
3. Floral axis articulated 5
4. Panicles dense; spikelets awnless ..... 5. Imperata
4. Panicles somewhat fan-shaped; spikelets awned. 6. Miscanthus
5. Spikelets awned ..... 8. Erianthus
5. Spikelets awnless ..... 7. Saccharum
6. First empty glume of the hermaphrodite spikelet flattened or somewhat convex ..... 9. Manisuris
6. First empty glume of the hermaphrodite spikelet hard and globular, pitted externally ..... 10. Hackelochloa
7. Rachis imperfectly articulated; primary spikelet on a short pedicel, awnless; secondary spikelet pedicellate and long awned ..... 11. Trachypogon
7. Rachis distinctly articulate; secondary spikelet sessile 8
8. Spikelets awnless ..... 12. Elionurus
8. Spikelets awned ..... 13. Andropogon

FIG. 5. **Imperata hookeri** Rupr. **WESTERN BLADY-GRASS.**—*a*, A portion of the axis of the inflorescence; *b*, a spikelet; *c*, first outer glume; *d*, second outer glume; *e*, third glume; *f*, fourth glume; *g*, palea. *Imperata brasiliensis* Trin. is illustrated by figure 303 in Bul. 17.

5. **IMPERATA** Cyrilli, Pl. Rar. Ic. **2**: 26. *t.* 11. 1792. Spikelets in pairs at each joint of the continuous panicle-branches, unequally pedicellate, articulated with the pedicels, 1-flowered, awnless, densely clothed with long, silky hairs. Glumes 4, the 2 outer membranaceous, the 2d a little longer than the 1st, the 3d empty, hyaline, as is the 4th when present. Palea broad, surrounding the ovary. Stamens 1 to 2. Styles connate at the base; stigmas rather long, linear, plumose. Rather stout, erect, perennial grasses, with spike-like and densely woolly, terminal panicles.

Species 5, widely distributed throughout the warmer countries of the world, two of which occur in North America.

FIG. 6. **Miscanthus japonicus** Anderss. EULALIA.—*a*, A spikelet; *b*, dorsal view of the first glume; *c*, similar view of the second glume.

6. **MISCANTHUS** Anderss. Oefvers. Vet. Akad. Förh. Stock. **12**: 165. 1855. Spikelets all alike, 1-flowered, hermaphrodite, in pairs along the continuous branches of a terminal, spreading panicle, the rachilla articulated below the empty glumes. Glumes 4, the 1st two membranaceous, nearly equal, empty; the 3d less firm in texture, empty; the 4th or flowering glume hyaline, more or less bifid at the apex and usually awned between the teeth. Palea hyaline. Stamens 3. Rather tall, usually showy grasses, with the numerous slender racemes of the terminal panicle more or less spreading.

Species 7, in eastern Asia, Japan, and South Africa, one introduced and cultivated for ornament.

FIG. 7. **Saccharum officinarum** L. SUGAR CANE.—*a*, A portion of a branch of the inflorescence with 2 spikelets attached; *b*, spikelet; *c*, flower.

7. **SACCHARUM** Linn. Sp. Pl. ed. 2, 1: 79. 1762. Spikelets all alike, perfect, awnless, in numerous, jointed racemes, forming a much branched terminal panicle. The somewhat hardened 1st and 2d glumes empty, equal, awnless, pilose with long silky hairs, especially on the callus; 3d glume, when present, empty and hyaline; the fourth or flowering glume awnless, or simply mucronate-pointed, hyaline. Tall, erect perennials, with usually simple culms, long leaves, and ample terminal panicles; the small spikelets surrounded by long silky hairs. Allied to *Erianthus*.

Species 12, chiefly in the tropics of the Old World, one, *S. officinarum*, cultivated in the Gulf States.

FIG. 8. **Erianthus compactus** Nash. DENSELY-FLOWERED PLUME-GRASS.—*a*, A spikelet; *b*, first glume; *c*, second glume; *d*, third glume; *e*, fourth or flowering glume; *f*, lodicules. Fig. 4 in Bul. 7 and fig. 304 in Bul. 17 illustrate other species of this genus.

8. **ERIANTHUS**, Michx. Flor. Bor. Am. I: 54. 1803. Spikelets in pairs, one sessile, the other pedicellate, along the articulate and readily disjointing panicle-branches, both alike, hermaphrodite. Glumes 4, the outer ones subequal, firm-membranaceous, the 1st flattened on the back and more or less bicarinate and 2-toothed at the narrowed apex; the 2d somewhat rounded on the back, sharply acuminate-pointed and more or less keeled above; the 3d empty and usually hyaline, awnless; the 4th awned and inclosing a hermaphrodite flower. Palea usually much shorter than its glume, nerveless; lodicules cuneate, ciliate, or naked. Tall, reed-like perennials, with the spikelets in many-jointed racemes, which are sessile along the main axis, forming an ample terminal and usually woolly panicle.

Species about 18, in the warmer regions of both hemispheres.

FIG. 9. **Manisuris tessellata** (Steud.) *Rottbœllia tessellata* Steud. TALL RAT-TAIL GRASS.—*a*, A portion of the axis of a spike; *b*, first glume; *c*, second glume; *d*, outer glume of the pedicillate spikelet; *e*, third glume of the sessile spikelet; *f*, fourth or flowering glume of same; *g*, palea inclosing flower; *h*, pedicellate spikelet with pedicel. Fig. 5 in Bul. 7 and figs. 306 and 307 in Bul. 17 illustrate other species of this genus.

9. **MANISURIS** L. Mant. **2**: 164. 1771, not Sw. (*Rottbœllia* L. f. 1779). Spikelets in pairs in the excavations at the nodes of a cylindrical, articulated axis; one sessile and hermaphrodite, the other pedicellate and sterile or neuter, with its pedicel grown to the axis. Glumes of the hermaphrodite spikelet 4, obtuse awnless, the outer one coriaceous, usually convex on the back and covering the excavation in the rachis; 2d glume less rigid than the 1st; the 3d empty or with a staminate flower, and hyaline, as are the 4th glume and palea. Stamens 3. Styles distinct. Caryopsis included within the outer glumes, but free. Usually slender grasses with rigid, smooth, and mostly cylindrical, simple spikes, which terminate the culm or its branches.

As now constituted, this genus contains about 31 species, common to the warmer regions of both hemispheres, a few extending into the warmer temperate regions of North America.

FIG. 10. **Hackelochloa granularis** (Sw.) Kuntze. LIZARD-TAIL GRASS.—*a*, A portion of a spike bearing four spikelets; *b*, a sessile and pedicellate spikelet; *d*, anterior view of the first or outer glume of the sessile spikelet; *e*, second glume of same; *f*, third glume of same; *g*, fourth or flowering glume; *h*, palea and flower; *c*, imperfect or pedicellate spikelet.

10. **HACKELOCHLOA** O. Kuntze, Rev. Gen. Pl. **2**: 776. 1891. (*Manisuris* Sw. 1797, not Linn. 1771.) Spikelets in pairs, partially embedded in the excavations of the articulate rachis, one sessile and hermaphrodite, the other pedicellate, the pedicel grown to the rachis. Glumes of the perfect spikelet awnless; the outer empty one coriaceous, globose, pitted externally, and covering the cavity in the rachis; the 2d equaling the 1st in length, less rigid, immersed in the cavity of the rachis; the 3d empty, and, like the 4th, hyaline. Palea minute or wanting; lodicules broadly wedge-shaped, truncate. Stamens 3. Styles distinct; stigmas plumose. Grain short, ovoid, included within the glumes, free. A much-branched annual grass with flat leaves and numerous slender spikes in irregular leafy panicles.

Species 1, occurring as a weed in all tropical or warmer temperate regions of the world.

FIG. 11. **Trachypogon polymorphus montufari** Hack.—*a*, A pair of spikelets; *b*, dorsal view of the sessile spikelet; *c*, *d*, *e*, *f*, 1st, 2d, 3d, and 4th glumes.

11. **TRACHYPOGON** Nees Agrost. Bras. 341. 1829. Spikelets as in *Andropogon*, 1-flowered, in pairs at the nodes of the imperfectly articulated rachis, one nearly sessile, awnless, sterile, the other pedicellate, fertile, and long-awned. Glumes usually 4, the outer one rigid, inclosing the others; 2d a little smaller and less rigid than the 1st; the 3d and 4th hyaline; 4th glume of the pedicellate spikelet very narrow at the base, and produced into a long twisted and geniculate awn. Rather tall perennial grasses with narrow leaves and usually solitary, long-exserted racemes.

Species 1, presenting many varieties. Southern Africa and adjacent islands, tropical and subtropical America, extending into Arizona.

FIG. 12. **Elionurus barbiculmis** Hack.—*a*, A pair of spikelets, one sessile, the other pedicellate; *b*, the pedicellate spikelet; *c*, first glume of the sessile spikelet; *d*, second glume of same; *e*, third glume; *f*, fourth or flowering glume; *g*, pistil showing lodicules. Another species of this genus is shown in fig. 308 of Bul. 17.

12. **ELIONURUS** H. & B. in Willd. Sp. Pl. **4**: 941. 1805. Spikelets nearly as in *Andropogon*, 1-flowered, awnless. First empty glume rigid or subcoriaceous, 2-toothed at the apex, margins inflexed, more or less densely ciliate, with balsam-bearing lines between the side keels; 2d glume a little shorter than the 1st, acute; the 3d glume empty, and, like the terminal flowering glume, very delicate and hyaline. Palea minute, or none. Stamens 3. Styles distinct; stigmas plumose. Low or tall annual or perennial grasses, with rather rigid leaves, and solitary, terminal racemes. The spikelets have a strong balsam-like odor when fresh or after soaking in water, and a sharp, pungent taste.

Species about 15, natives of tropical and subtropical America, Africa, western India, and Australia; 2 species in the United States, southern and southwestern.

FIG. 13. **Andropogon provincialis** Lam. (*A. furcatus* Muhl.) BIG BLUESTEM.—*a*, A sessile and pedicellate spikelets; *b*, first glume of the sessile spikelet; *c*, second glume of the same; *d*, third glume; *e*, fourth or flowering glume, which is awned; *f*, palea; *g*, lodicules. Other species of this genus are illustrated by figures 8–17 in Bul. 7, and 309–323 in Bul. 17.

13. **ANDROPOGON** Linn. Sp. Pl. 1045. 1753. Spikelets heterogamous, in pairs (or the terminal ternate) at each joint of the articulate and usually hairy rachis, one of each pair (the primary spikelet) sessile, hermaphrodite, and 1-flowered, the other pedicellate and either staminate, neutral, or reduced to the pedicel. Glumes of the fertile spikelet 4; the 1st cartilaginous or coriaceous, flattened on the back with a strong nerve near each margin and usually with less prominent nerves between; 2d glume as long as the 1st, but more pointed and keeled; 3d glume empty and usually hyaline; 4th or flowering glume hyaline, awned. Stamens 3. Styles distinct; stigmas plumose. Grain unfurrowed; free within the hardened outer glumes. Slender or rather coarse perennials with solid culms, growing chiefly in dry, sandy, or sterile soils.

Species about 180, widely distributed over both hemispheres, especially in the tropical and subtropical regions. About forty species in the United States, chiefly in the South and Southwest.

Tribe III.—OSTERDAMIÆ.

Spikelets solitary or in groups of 2 to 8, each group falling as a whole from the continuous rachis, usually 1-flowered, hermaphrodite, or staminate and hermaphrodite in the same group; flowering glume less firm in texture than the awned or awnless outer ones, which are herbaceous, chartaceous, or coriaceous; the first glume is usually larger than the second.

A small tribe, numbering about 25 species, which represent nearly half that number of genera. Fifteen species are natives of the tropical and warmer temperate regions of America. Black grama, or *Gulleta*, of the Mexicans, is our best-known representative of the tribe.

KEY TO THE GENERA OF THE OSTERDAMIÆ.

1. Spikelets solitary, empty glume one, coriaceous, awnless.
   17. Osterdamia
1. Spikelets in clusters of from three to several at each joint of the main axis, empty glumes two 2

2. Second empty glume coriaceous with hooked spines on the back ..... 16. Nazia
2. Second empty glume without hooked spines on the back.... 3

3. Spikelets secund along the main axis, the lower spikelets in each group sterile ..... 15. Ægopogon
3. Spikelets not secund along the main axis, the two lower or outer spikelets 2-flowered and staminate..... 14. Hilaria

FIG. 14. **Hilaria cenchroides** H. B. K. CURLY MESQUITE.—*a*, A group of three spikelets; *b*, one of the staminate spikelets; *d*, the pistillate spikelet, showing the exserted stigmas; *c*, two staminate florets, the firm outer glumes removed. Other species of this genus are illustrated by figures 19, 20, and 21 of Bul. 7.

14. **HILARIA** H. B. K., Nov. Gen. et Sp. Pl. 1: 116, *t.* 37. 1815. Spikelets sessile, in groups of three at each joint of the zigzag, continuous rachis, forming terminal spikes, the several groups falling off entire; the two outer or anterior spikelets staminate and 2—3-flowered, the posterior or inner one (next the rachis) pistillate or hermaphrodite, and 1-flowered. Empty or outer glumes firmer in texture than the others, unequal, many-nerved, more or less connate below, entire at the apex or more often divided, usually unequally 2-lobed with one to several intermediate awns or awn-like divisions; glumes of the inner or fertile flower much narrower than those of the others. Stamens 3. Styles connate below; stigmas shortly plumose. Grain ovate or oblong, included within the glumes, free. Cæspitose or decumbent grasses, often stoloniferous with flat or involute leaves and terminal, solitary spikes.

Species 5, in the Southwest, ranging from Colorado to Mexico.

FIG. 15. **Ægopogon cenchroides** Willd.—*a*, A group of spikelets; *b*, a perfect spikelet; *c*, 1st glume; *d*, the second glume; *e*, flowering glume; *f*, palea.

15. **ÆGOPOGON** H. & B. in Willd. Sp. Pl. **4**: 899. 1805. Spikelets sessile, in groups of 3 to 5 at each joint of the main axis, 1-flowered, hermaphrodite or the outer ones in each group imperfect or sterile. Empty glumes 2, usually 3-dentate or 3-lobed, the lateral lobes smaller, the middle one often extending into an awn; flowering glume 3-nerved, 3-lobed, or 3-toothed. Palea 2-nerved, 2-lobed, or bicuspidate. Stamens 3. Styles distinct; stigmas plumose. Grain oblong, included in the glumes, free. Slender, diffuse, or cæspitose grasses with narrow, flat leaves and terminal, secund, spike-like inflorescence. Glumes delicate, the fertile and sterile often intermixed.

Species 2 or 3, Lower California, Mexico, to Brazil. A genus with the habit of *Melanocenchrus*.

FIG. 16. **Nazia aliena** (Spreng.) Scribn. (*Lappago aliena* Spreng.) WESTERN PRICKLE-GRASS.—*a*, A group of spikelets; *b*, the second glume covered with hooked spines; *c* and *d*, flowering glume and palea.

16. **NAZIA** Adans. Fam. Pl. **2**: 31, 581. 1763. (*Tragus* Hall, 1768). Spikelets in groups of three to several at each joint of the main axis, the uppermost in each fascicle sterile, 1-flowered. First glume minute or wanting, the 2d rigid, exceeding the flowering glume, its back covered with hooked spines; flowering glume and palea hyaline, distinctly shorter than the 2d glume. Stamens 3. Style short and distinct; stigmas rather long, plumose. Grain oblong, included in the glumes, but free. Diffusely branched annuals with flat leaves and terminal, spike-like inflorescence.

Species 2 or 3, in the tropical and warmer temperate regions of both hemispheres.

FIG. 17. **Osterdamia matrella** (L.) Kuntze (*Zoysia pungens* Willd). KOREAN LAWN GRASS.—*a*, A spikelet with stigmas protruding from near the apex; *a'*, a smaller spikelet; *b*, second glume; *c*, palea; *d*, stamens.

17. **OSTERDAMIA** Neck., Elem. Bot. **3**: 218. 1790. (*Zoysia* Willd. 1801.) Spikelets subsessile or shortly pedicellate along the continuous rachis of the main axis, 1-flowered, hermaphrodite. Empty glumes 1, strongly compressed, keeled, awnless, coriaceous, inclosing the much smaller flowering glume. Stamens, 3. Styles distinct; stigmas plumose. Grain included in the slightly indurated outer glume, free. Creeping or stoloniferous grasses with rather rigid, often sharp-pointed leaves, and slender, terminal spikes.

Species 2 or 3, southern Asia, Mascarene Islands, Australia, and New Zealand. One introduced under the name of "Korean lawn grass."

Tribe IV.—TRISTEGINEÆ.

Spikelets all hermaphrodite, in panicles; empty glumes three, or the third with a staminate flower in its axil, herbaceous or chartaceous; flowering glumes membranaceous, awned or awnless; rachilla articulated below the empty glumes.

A small tribe of only seven genera and thirty-three species, natives chiefly of the tropical regions of the Old World. Of the few American species none extend so far north as the United States.

Tribe V.—PANICEÆ.

Spikelets hermaphrodite, terete or flattened on the back; glumes three or four (rarely only two); when four, there is occasionally a staminate flower or a palea in the axil of the third; the uppermost or flowering glume of the hermaphrodite flower is always firmer in texture than the outer glumes, of which the first is usually smaller than the others; axis of the inflorescence not articulated, the rachilla being articulated below the empty glumes, the spikelets falling off singly from their pedicels.

This is one of the largest tribes in the order Gramineæ. It contains twenty-two genera with over six hundred and thirty species. *Panicum*, the principal genus, is the largest among grasses, numbering three hundred species. The *Paniceæ* are very widely distributed throughout the tropical and temperate regions of the world. Crab grass and the millets are among our best known examples of this tribe.

KEY TO THE GENERA OF THE PANICEÆ.

1. Spikelets unisexual, the staminate in terminal panicles, the fertile on short, leafless, subterranean branches.. 21. Amphicarpum
1. Spikelets all hermaphrodite..... 2

2. Spikelets half imbedded in the flattened axis of the spike-like panicle..... 28. Stenotaphrum
2. Spikelets not sunken in excavations along the main axis.... 3

3. Spikelets subtended or surrounded by one to many bristles or spines which are distinct or more or less connate below... 4
3. Spikelets not surrounded by a bristly or spiny involucre.... 6

4. Bristles or spines falling off with the spikelets..... 5
4. Bristles not falling with the spikelets..... 25. Chætochloa

5. Bristles thickened or connate below, becoming hard and bur-like ..... 26. CENCHRUS
5. Bristles not connate below, usually slender and often plumose. 27. PENNISETUM

6. Glumes, including the flowering, two, usually acuminate-pointed ..... 18. REIMARIA
6. Glumes more than two 7

7. Glumes three 8
7. Glumes four 10

8. Spikelets with an enlarged annular callus at the base, flowering glume mucronate or short awn-pointed ..... 22. ERIOCHLOA
8. Spikelets without an annular callus at base; flowering glume awnless 9

9. Spikelets in loose terminal panicles ..... 20. ANTHÆNANTIA
9. Spikelets sessile or very short pedicelled, in one-sided spikes or racemes ..... 19. PASPALUM

10. First glume usually smaller than the others (rarely wanting), awnless ..... 23. PANICUM
10. First and second, and sometimes also the third, glumes awned. 24. OPLISMENUS

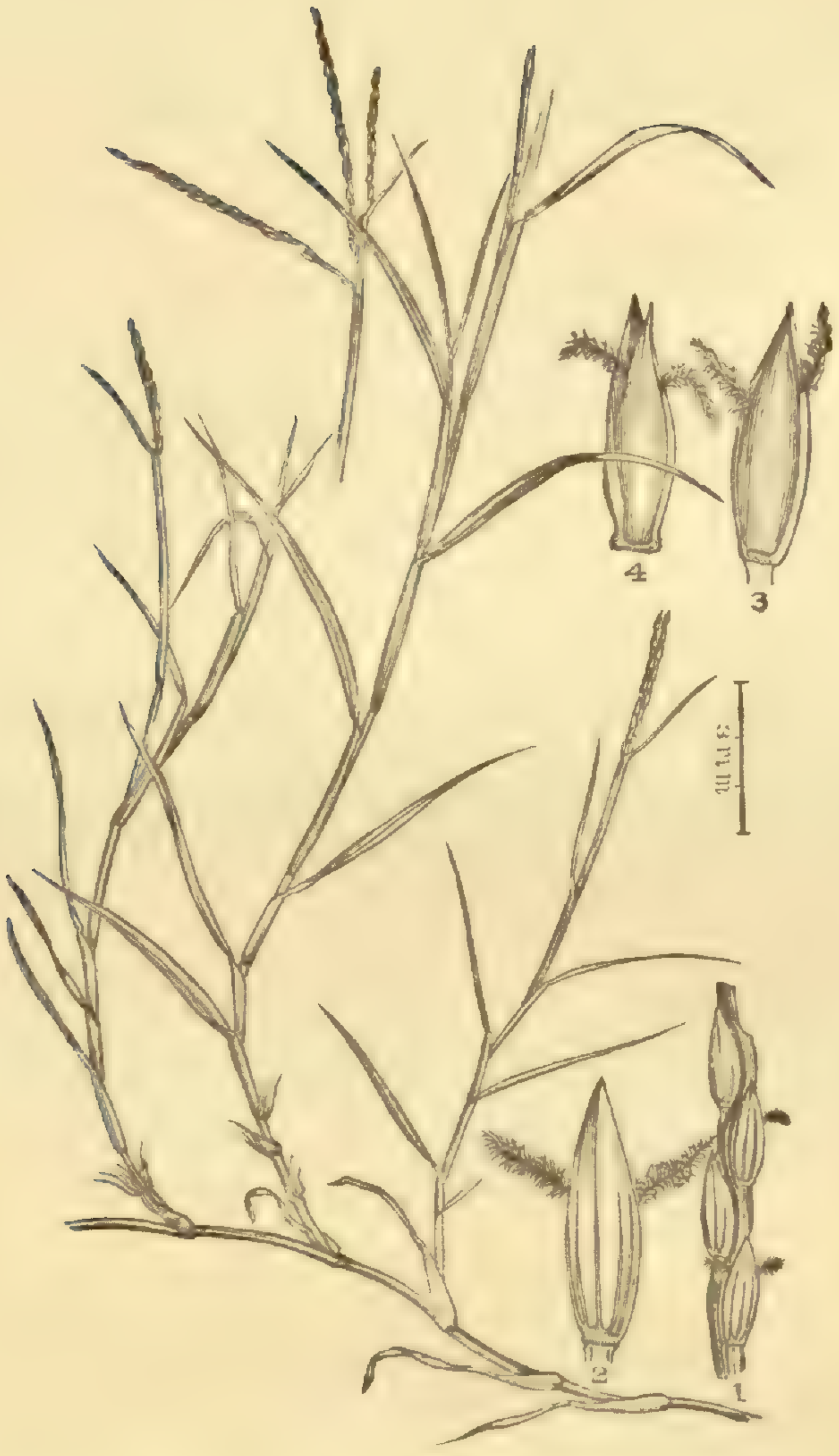

FIG. 18. **Reimaria oligostachya** Munro. CREEPING REIMARIA.—1, A portion of a spike showing four spikelets; 2, a single spikelet showing the first or empty glume; 3, 4, views of the same, showing the flowering glume. The stigmas project from the sides near the apex.

18. **REIMARIA** Fluegge Monog. 213. 1810. Spikelets narrowly ovate or acuminate, subsessile in unilateral spikes. Empty glume 1, membranaceous, 3–5 nerved, acute; flowering glume similar or somewhat indurated, usually a little shorter than the outer glume. Stamens usually 2. Styles distinct; stigmas long-plumose. Grain oblong, somewhat compressed, included within the glumes, but free. Diffusely branching, cæspitose or stoloniferous perennials, with two to many, erect or reflexed spikes, which are usually crowded near the apex of the ascending branches.

Species 4, in tropical and subtropical America, one extending into Florida.

FIG. 19. **Paspalum læve** Michx. SMOOTH PASPALUM.—*a*, A portion of a raceme, dorsal view showing axis; *b*, anterior view of a spikelet; *c*, dorsal view of a spikelet; *d*, a spikelet showing its attachment to the rachis. Figures 23 to 31 in Bul. 7 and figs. 325 to 335 in Bul. 17, illustrate other species of this genus.

19. **PASPALUM** Linn. Syst. Nat. ed. 10, **2**: 855. 1759. Spikelets 1-flowered, plano-convex, nearly sessile in 2 to 4 rows along one side of a continuous narrow or dilated rachis, forming simple racemes, these either solitary or two or more, digitate or paniculate; rachilla articulated below the empty glumes. Glumes 3 (rarely only 2 or 4) awnless, usually obtuse, the 1st two empty, membranaceous, equal or nearly so, and usually as long as cartilaginous 3d glume which incloses a palea of similar texture and a hermaphrodite flower. Grain oblong, inclosed with the indurated fruiting glume and palea. Perennials, very variable in habit, usually growing in moist grounds.

Species about 160 widely distributed, especially abundant in the tropical regions of America. There are about 40 species and varieties in the United States, chiefly in the southern districts.

FIG. 20. **Anthænantia rufa** (Ell.) Schultes.—*a*, A spikelet; *b*, flowering glume. Figure 337 in Bul. 17 illustrates a second species of this genus.

29. **ANTHÆNANTIA** Beauv. Agrost. 48. *t. 10, f. 7.* 1812. Spikelets ovate, 1-flowered, hermaphrodite, loosely paniculate. Empty glumes 2, slightly unequal, the 2d with a small palea or inclosing a staminate flower: flowering glume slightly indurated, usually a little shorter than the empty ones. Stamens 3. Styles distinct; stigmas plumose. Grain loosely inclosed within the fruiting glume. Erect, cæspitose perennials with narrow, flat leaves; loose, terminal panicles, and pilose or pubescent spikelets, the glumes of which are as in *Paspalum*.

Species 3, two in North America and the other in tropical South America.

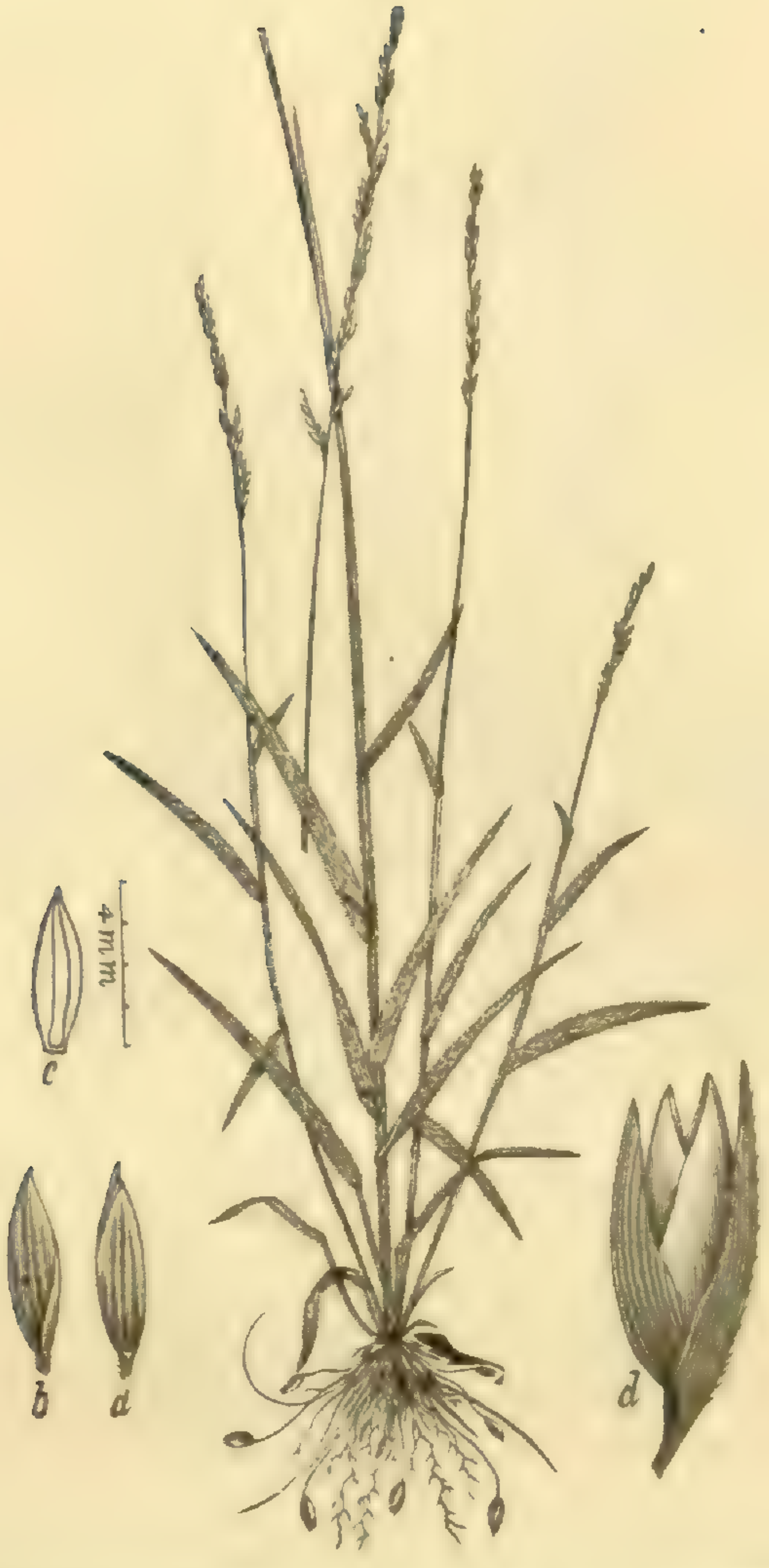

FIG. 21. **Amphicarpum purshii** Kunth.—*a* and *b*, Staminate spikelets; *c*, floret of same; *d*, a fertile spikelet from one of the underground branches. One other species from Florida is illustrated by figure 33 in Bul. 7.

21. **AMPHICARPUM** Kunth. Rev. Gram. I: 28. 1835. Spikelets (by abortion) unisexual, 1-flowered, the staminate in a narrow terminal panicle, the pistillate much larger, solitary, terminal on slender leafless runners at the base of the culm and cleistogamous. Glumes 3, awnless, slightly unequal, the 1st and 2d empty, membranous, the 3d in the fertile spikelets firmer in texture and becoming indurated in fruit. Stamens 3. Styles distinct; stigmas plumose. Grain oblong, inclosed within the hardened floral glume and palea. Erect perennials, with flat leaves and terminal panicles.

Two known species, natives of eastern North America.

FIG. 22. **Eriochloa mollis** (Michx.) Kunth. SOFT WOOL-GRASS.—1, A single spikelet; 2, the same with the outer empty glumes removed; 3, palea inclosing a pistil; 4, a palea inclosing stamens. Figures 35 and 36 of Bul. 7 and figure 338 in Bul. 17 illustrate other species of this genus.

22. **ERIOCHLOA** H. B. K. Nov. Gen. et Sp. Pl. I: 94. 1815. (*Helopus* Trin., 1820.) Spikelets 1-flowered, hermaphrodite; rachilla articulated below the empty glumes, where it is expanded into a distinct, ring-like callus. Empty glumes 2, nearly equal, membranaceous, more or less acuminate-pointed, the 3d or flowering glume slightly indurated, mucronate, or short awn-pointed. Palea shorter than its glume. Stamens 3. Styles distinct; stigmas plumose. Caryopsis included within the hardened fruiting glume, free. Annual (?) or perennial grasses, with usually thin flat leaves and terminal panicles, composed of numerous, somewhat one-sided racemes.

Species 5 or 6, in the subtropical or warmer temperate regions of both hemispheres.

FIG. 23. **Panicum miliaceum** L.—*a*, A spikelet showing the first and third glumes; *b*, a spikelet showing the lower margins of the first and dorsal surface of the second glume; *c*, anterior view of the third glume, showing the small palea in its axis; *d*, dorsal view of the fourth or flowering glume; *e*, anterior view of same, showing the palea. Figures 37 to 64 in Bul. 7 and 339 to 399 in Bul. 17 illustrate other species of the genus.

23. **PANICUM** Linn. Sp. Pl. 55. 1753. Spikelets 1-flowered or sometimes with a staminate flower below the hermaphrodite terminal one, in spikes, racemes, or panicles. Glumes 4, the 1st usually much shorter than the others, very rarely wanting (some species of section *Syntherisma*); 2d glume empty, equaling or somewhat shorter than the 3d, which is empty or has a palea or even a staminate flower in its axil; 4th glume smooth and shining, coriaceous, much firmer in texture than the others. Palea similar in texture to its glume and closely embraced by it. Grain inclosed within the hardened fruiting glume and palea, free. Annuals or perennials varying greatly in habit of growth, foliage, and inflorescence.

Species about 300, throughout the tropical and subtropical regions of both hemispheres; a few only in the temperate regions. Several species occur as weeds throughout all civilized countries. Nearly 100 species and varieties are recorded as having been found within the United States.

FIG. 24. **Oplismenus hirtellus** (Linn.) R. & S. CREEPING BEARD-GRASS.—*a*, A spikelet showing the outer empty glumes and the upper portion of the 3d and 4th glumes.

24. **OPLISMENUS** Beauv. Fl. Owar. et Ben. **2**: 14, *t. 68.* 1807. (*Orthopogon* R. Br.) Spikelets 1-flowered, in small groups or clusters, usually unilateral along the branches of the paniele. Outer empty glumes 3, more or less awned, the 3d glume usually with a palea; flowering glume shorter than the 3d glume, obtuse, awnless, with the palea becoming indurated at maturity. Stamens 3. Styles distinct to the base; stigmas plumose. Grain included within the hardened fruiting glume and palea, free. Usually weak, much branched, creeping or ascending grasses, with narrow or broad, lanceolate, flat leaves, terminal panicles composed of unilateral racemes.

Species 4 or 5, in tropical or subtropical regions of both hemispheres.

FIG. 25. **Chaetochloa glauca** (Linn.) Scribn. (*Setaria glauca* Beauv.) YELLOW FOXTAIL.—*a*, A spikelet showing the second glume, the upper portion of the fourth or flowering glume and the numerous bristles which surround the spikelet at the base; *b*, a spikelet showing the back of the first and third glumes. Figures 65 to 68 in Bul. 7 and 402 and 403 in Bul. 17 illustrate other species of this genus.

25. **CHAETOCHLOA** Scribn. U. S. Dept. Agr., Div. Agros. Bul. **4**: 38. 1897. (*Setaria* Beauv., 1812, not Acharius, 1798.) Spikelets hermaphrodite, 1-flowered or sometimes with a staminate flower below the hermaphrodite terminal one, surrounded by few or many persistent, awn-like branches which spring from the pedicels below the articulation of the spikelets, and impart to the dense cylindrical or somewhat interrupted spikelike panicles a bristly appearance. Glumes as in *Panicum*, awnless. Stamens 3. Styles distinct; stigmas plumose. Grain included within the hardened flowering glume and palea, but free from them. Annual or perennial grasses with flat leaves and bristly, spikelike panicles.

Species about 40 in the warmer regions of the world. Twenty-eight species occur in North America, chiefly in the southern and southwestern United States and Mexico; three are cosmopolitan weeds.

FIG. 26. **Cenchrus tribuloides** L. SAND BUR.—*a*, A spiny bur which incloses the spikelets; *b*, a section of the same showing the spikelets within; *c*, a lateral view of one of the spikelets showing the several glumes. Figures 404 to 407 in Bul. 17 illustrate other species of this genus.

26. **CENCHRUS** Linn. Sp. Pl. 1049. 1753.—Spikelets 1-flowered hermaphrodite (rarely with a male flower below the perfect terminal one), 1–4 together with an ovoid or globular involucre of rigid more or less connate bristles forming spiny burs or false capsules, these sessile or nearly so in simple terminal spikes or racemes, falling off with the spikelets. Glumes as in *Panicum* awnless. Grain free within the slightly hardened fruiting glume and palea. Annual or perennial grasses with spreading or erect culms bearing few or many more or less crowded "burs" in terminal spikes.

Species about 12, in the tropical and warmer temperate regions of both hemispheres.

FIG. 27. **Pennisetum setosum** (Sw.) Rich.—*a*, A spikelet surrounded by ciliate bristles; *b*, the same with the bristles removed, showing 2 stamens and 2 stigmas; *c*, flowering glume.

27. **PENNISETUM** Pers. Syn. 1: 72. 1805. Spikelets solitary or 2–3 together, subtended by an involucre of one to many bristles, which are often plumose and fall off with the spikelets at maturity; inflorescence racemose or dense and spike-like. Glumes 4; the 1st empty and smaller than the others; the 2d usually as long as the spikelet, empty; the 3d empty, or with a palea or a staminate flower; the 4th or terminal inclosing a pistillate or hermaphrodite flower and palea. Stamens 3. Styles distinct or more or less connate below; stigmas plumose. Grain included in the rigid fruiting glume and palea, free. Annual or perennial grasses, with simple or branched culms; flat leaves with usually spike-like panicles terminal on the culm or its branches.

Species about 40, chiefly natives of the tropical and subtropical regions of the Old World; a few in America.

FIG. 28. **Stenotaphrum secundatum** (Walt.) Kuntze.—*a*, A portion of the axis of one of the spikes, showing 7 spikelets; *b* and *c*, spikelets.

28. **STENOTAPHRUM** Trin. Fund. Agros. 175. 1820. Spikelets 2-flowered, the lower staminate or hermaphrodite, 2–4 in very short spikes imbedded in one side of a flattened rachis, forming a spike-like paniele. Empty glumes 3, the outer one very small, sometimes wanting; the 3d usually with a palea or staminate flower in its axil; the 4th (or the 3d glume in the absence of the 1st) containing an hermaphrodite flower. Stamens 3. Styles distinct to the base; stigmas plumose. Grain oblong, included within the somewhat rigid glumes and palea, free. Creeping, stoloniferous perennial grasses with short, ascending branches; spreading, flat, or convolute leaves; and spike-like, terminal inflorescence.

Species 3 or 4, one of which is widespread in the tropical and subtropical regions of both hemispheres; the others are natives of the islands of the Indian and Pacific oceans.

Tribe VI.—ORYZEÆ.

Spikelets usually much compressed laterally, 1-flowered, staminate, pistillate, or hermaphrodite; empty glumes 2 or none, the flower being subtended by the floral glume and palea alone, the latter 1-nerved and regarded by some as a second glume; stamens frequently 6; axis of the inflorescence not articulated.

A small tribe of about forty species divided among sixteen genera, mostly confined to tropical America. One of the best known and most extensively used of the cereals, rice (*Oryza sativa*), belongs here.

KEY TO THE GENERA OF THE ORYZEÆ.

1. Spikelets unisexual, plants monoecious 2
1. Spikelets hermaphrodite, strongly compressed 6

2. Inflorescence of terminal and axillary spikes, the former pedunculate and staminate, the latter sessile and pistillate.
29. Hydrochloa
2. Inflorescence paniculate 3

3. Spikelets in pairs, the pistillate large and sessile, the staminate small and pedicellate ..... 30. Pharus
3. Spikelets not in pairs 4

4. Staminate and pistillate spikelets in separate panicles or in the same panicle when the staminate are terminal.. 31. Luziola
4. Staminate and pistillate spikelets in the same panicle, the pistillate above, the staminate below 5

5. Fruiting spikelets narrow, subterete, caryopsis linear.
33. Zizania
5. Fruiting spikelets subcompressed, caryopsis ovate.
32. Zizaniopsis

6. Empty glumes two, flowering glume often awned.. 34. Oryza
6. Empty glumes none, flowering glume awnless.
35. Homalocenchrus

FIG. 29. **Hydrochloa fluitans** (MX.) Torr.—*a*, A branch showing the inflorescence; *b*, a staminate spikelet; *c*, a pistillate spikelet; *d* and *e*, grain.

29. **HYDROCHLOA** Beauv. Agrost. 135. 1812. Spikelets unisexual, monœcious, the staminate terminal, the pistillate axilliary. Glumes 2, somewhat unequal, membranaceous, concave, awnless; palea none. Stamens 6. Styles short, distinct; stigmas elongated, plumose. Grain included within the glumes, free. A slender branching, floating or creeping, aquatic grass, with narrow floating leaves and few spikelets in terminal and axillary spikes.

Species 1. Southern United States.

FIG. 30. **Pharus latifolius** L.—*a*, A branch showing a sessile pistillate and a pedicellate staminate spikelet; *b*, fruiting spikelet removed from the empty glumes.

30. **PHARUS** P. Browne, Civ. and Nat. Hist. Jamaic., 344. 1756. Spikelets unisexual, monœcious, 1-flowered, in pairs along the branches of the panicle; one sessile and pistillate, the other much smaller, pedicellate and staminate. Staminate spikelet with 3 rather broad, membranaceous, and many-nerved glumes; the 1st two empty, slightly unequal, the 2d about as long as the flowering glume. Palea none. Stamens 6. Pistillate spikelet with 3 glumes, the 1st two empty, membranaceous, many-nerved, subequal, much shorter than the long, coriaceous flowering glume, which closely envelops the 2-nerved palea. Stamens none. Styles filiform, elongated; stigmas 3, shortly papillate-pilose. Grain terete, linear, included within the indurated fruiting glume. Rather stout, tropical grasses, with broad and long-petiolate leaves and terminal panicles.

Species 4 or 5, tropical America, 1 in southern Florida.

FIG. 31. **Luziola alabamensis** Chapm.—*a*, A pistillate spikelet; *b*, a staminate spikelet; *c*, a pistil; *d*, a grain or caryopsis.

31. **LUZIOLA** Juss. Gen. Pl. 33. 1789.—Spikelets small, ovate, unisexual, monœcious, the male and female in separate panicles in our species, 1-flowered, arranged along the continuous panicle-branches, articulated with the pedicels. Empty glumes none; flowering glume and narrower palea of the staminate spikelets thin-membranaceous, awnless; stamens 6 to 18. Female spikelets smaller than the staminate, and the rather broad glume many-nerved; stamens none. Styles short, distinct; stigmas plumose. Grain ovate, free within the glume and palea. Marsh or aquatic grasses, creeping or floating at the base, with flat leaves, and terminal or axillary diffuse panicles.

Species 6, in the warmer parts of North and South America.

FIG. 32. **Zizaniopsis miliacea** (Michx.) Doell & Aschers. (*Zizania miliacea* Michx.) WATER MILLET.—*a*, *b*, Pistillate spikelets; *c*, a staminate spikelet.

32. **ZIZANIOPSIS** Doell & Aschers. in Mart. Flor. Bras. **2**[2]: 12, *t.* 3. 1871. Spikelets unisexual, monœcious, the staminate above, the pistillate below on each branch of the paniculate inflorescence. Glumes 2, nearly equal, membranaceous, the outer one broader, acute, or in the female spikelet short-awned. Palea none. Stamens 6. Styles united. Grain ovate or nearly globose, **pericarp readily separable.** A reedlike aquatic grass, the ovate pistillate spikelets on the same branches with the staminate flowers.

Species 1, with several varieties. Southern United States and South America.

FIG. 33. **Zizania aquatica** Linn. WILD RICE, "REEDS."—*a*, A pistillate spikelet; *b*, palea and flower of same; *c*, a staminate spikelet; *d*, first glume of same.

33. **ZIZANIA** Linn. Sp. Pl. 991. 1753. Spikelets unisexual, monœcious, 1-flowered, the linear pistillate spikelets on the somewhat appressed upper branches, the staminate on the expanded lower branches of the same ample panicle. Glumes 2, nearly equal, membranaceous, the outer one slightly larger, awnless, or in the female spikelet long-awned. Palea none. Stamens 6. Styles nearly distinct, the plumose stigmatic hairs long. Grain linear, 6 to 8 lines long. A tall aquatic grass, with long leaves, ample panicles, and highly farinaceous grain.

A monotypic genus of North America and Northeastern Asia.

FIG. 34. **Oryza sativa** L. RICE.—*a*, A spikelet; *b*, a flower showing the lodicules; *c*, grain.

34. **ORYZA** Linn. Sp. Pl. 333. 1753. Spikelets 1-flowered, hermaphrodite, strongly flattened laterally in terminal panicles; rhachilla articulated below the empty glumes. Glumes, 3, the 1st two small, empty, the 3d compressed, keeled, somewhat rigid, usually awned. Palea 1-nerved, narrower, but about the length of the glume. Stamens 6. Grain oblong obtuse, closely enveloped by the fruiting glume. Aquatic grasses with flat leaves and terminal panicles.

Species 5 or 6, in the tropics of both hemispheres.

FIG. 35. **Homalocenchrus oryzoides** (Sw.) Poll. (*Leersia oryzoides* Sw.). RICE CUT-GRASS.—*a*, A branch of the inflorescence bearing several spikelets; *b*, *c*, spikelets; *d*, *e*, grain. Figures 74, 75, 77, and 78 in Bul. 7 illustrate other species of this genus.

35. **HOMALOCENCHRUS** Mieg., in Hall. Hist. Stirp. Helv. **2**: 201. 1768. (*Leersia* Swartz.) Spikelets 1-flowered, hermaphrodite, strongly flattened laterally, articulated with the pedicels. Empty glumes, none; flowering glume chartaceous, usually bristly-ciliate along the keel, awnless. Palea[1] similar in texture and about as long as the flowering glume, but much narrower. Perennials, with rough leaves and open paniculate inflorescence.

Species, 5 or 6, throughout the tropical and temperate regions of the world.

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[1] It is a question whether the 1-nerved bract here termed the palea, is a true palea—the prophyllum of the minute floral branch—or a proper glume attached to the rhachilla or primary axis of the spikelet.

Series B.—POACEÆ.

Spikelets 1- to many-flowered, the imperfect or rudimentary flower, if any, usually uppermost; rachilla usually articulated above the empty glumes, so that these remain after the fall of the fruiting glumes.[1] In spikelets with two or more flowers these are separated by a manifest internode of the rachilla, and in such cases the rachilla is usually articulated below each flowering glume.

In this second grand division of the Graminea the pedicels are not (or very rarely) articulated below the outer glumes but the axis of the spikelet is articulated above these glumes, so that they usually remain attached to the pedicel after the falling off of the mature florets. The spikelets are one- to many-flowered, and have as many flowering glumes as there are flowers; the imperfect flowers, when present, are the uppermost; the terminal floret may be staminate or rudimentary.

KEY TO THE TRIBES IN SERIES B.—POACEÆ.

1. Spikelets 1-flowered, with or without a simple continuation of the rachilla behind the palea 2
1. Spikelets two- to many-flowered..... 5

2. Spikelets crowded in two (rarely one) rows along one side of a continuous rachis forming unilateral spikes, these scattered along a common axis or digitate at the apex of the stem..... Tribe X. CHLORIDEÆ. (See page 97)
2. Spikelets not disposed in unilateral spikes 3

3. Inflorescence spicate, the spikelets sessile on alternate teeth or notches of the rachis... Tribe XII. HORDEÆ. (See page 157)
3. Inflorescence racemose (not unilateral) or paniculate, occasionally contracted and spike-like, or condensed and apparently capitate; spikelets always distinctly pedicellate..... 4

4. Glumes five, the first four empty or (in *Savastana*) the third and sometimes the fourth, which are usually very unlike the first and second, with staminate flowers; the fifth glume with a hermaphrodite flower, and falling with the third and fourth; palea 1-nerved..... Tribe VII. PHALARIDEÆ. (See page 53)

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[1] In *Alopecurus*, *Cinna*, *Polypogon*, *Spartina*, *Beckmannia*, *Limnodea*, and *Holcus* the rachilla is articulated below the empty or outer glumes, and the spikelets fall off entire.

4. Glumes three (only one in *Coleanthus*, or occasionally four in some species of *Sporobolus* and *Muhlenbergia*), the first two empty; palea 2-nerved or nerveless, very rarely 1-nerved (*Cinna*) or wholly wanting (*Alopecurus* and some species of *Agrostis*) ..... Tribe VIII. AGROSTIDEÆ. (See page 57)

5. Culms herbaceous, annual; leaf blade continuous with its sheath 6
5. Culms woody, perennial; leaf blade articulated with its sheath..... Tribe XIII. BAMBUSEÆ. (See page —)

6. Spikelets pedicellate, in panicles, spike-like panicles, or racemes, these never unilateral 7
6. Spikelets sessile, in true spikes, or on very short pedicels in unilateral racemes..... 8

7. Empty glumes generally longer than the first flowering glume; one or more of the flowering glumes awned on the back or from between the teeth of the bifid apex (some cultivated forms excepted); awn twisted, usually geniculate, very rarely straight..... TRIBE IX. AVENEÆ. (See page 87)
7. Empty glumes generally shorter than the floral glume; flowering glume awnless or with from one to many terminal (very rarely dorsal) straight or simply divergent awns.....
..... Tribe XI. FESTUCEÆ. (See page 112)

8. Spikelets in unilateral spikes or racemes, these racemed, digitate or fasciculate..... Tribe X. CHLORIDEÆ. (See page 97)
8. Spikelets inserted on the alternate teeth or notches of the rachis forming equilateral, flattened, or cylindrical terminal spikes ..... Tribe XII. HORDEÆ. (See page 157)

Tribe VII.—PHALARIDEÆ.

Spikelets more or less laterally compressed, one- or rarely three-flowered; glumes five, the first two empty and below the articulation of the rachilla, the third and fourth above the articulation, usually empty, very unlike the outer ones, rarely subtending staminate flowers, sometimes reduced to mere bristles, the fifth glume with a one-nerved or nerveless palea and a hermaphrodite flower.

A small tribe, comprising six genera with about sixty species of comparatively little importance. Several of the species, sweet vernal grass and vanilla grass, are remarkable for possessing a peculiar fragrance due to their containing coumarin. Canary-grass is one of the best known members of this tribe.

KEY TO THE GENERA OF THE PHALARIDEÆ.

1. Third and fourth glumes narrow and bristle-like, outer glumes strongly compressed..... 36 Phalaris
1. Third and fourth glumes broadly ovate or oblong, outer glumes not strongly flattened..... 2

2. Outer glumes very unequal, the third and fourth glumes much shorter than the outer ones and awned .. 37 Anthoxanthum
2. Outer glumes nearly equal, scarcely exceeding the third and fourth, which are awnless or very short awned. 38 Savastana

FIG. 36. **Phalaris caroliniana** Walt. (*P. intermedia* Bosc.). SOUTHERN CANARY-GRASS.—*a*, *b*, Spikelets; *c*, the same with the outer glumes removed, showing the hairy, bristle-like second and third glumes; *d*, another view of the same. **Figs. 79 and 81 in Bul. 7, and 411 and 412 in Bul. 17, illustrate other species of this genus.**

36. **PHALARIS** Linn. Sp. Pl. 54, 1753. Spikelets 1-flowered, strongly flattened laterally; rachilla articulated above the first pair of empty glumes. Glumes 5, awnless, the first two empty, equal, boat-shaped, and usually winged on the keel, the 3d and 4th empty, narrow-lanceolate or bristle-form, closely appressed to the 5th or flowering glume, which is hard and shining in fruit and closely envelops the grain and palea. Annual or perennial grasses with flat leaves and densely flowered, spike-like or capitate inflorescence sometimes expanded in flower.

Species about 10, most abundant in southern Europe. **There are 2 or perhaps 3 native North American species.**

FIG. 37. **Anthoxanthum odoratum** L. SWEET VERNAL-GRASS.—*a*, A spikelet; *b*, the same with the outer glumes removed, showing the awned 2d and 3d glumes; *c*, flowering glume, inclosing the stamens and pistil, which project above.

37. **ANTHOXANTHUM** Linn. Sp. Pl. 28. 1753. Spikelets hermaphrodite, 1-flowered, narrow, somewhat compressed. Glumes 5, the 1st and 2d empty, unequal, awnless, or mucronate-pointed; the 3d and 4th empty, shorter, 2-lobed, clothed with brown hairs, and awned below on the back; 5th shorter than the others, hyaline, broadly obtuse, awnless. Palea (?) narrower, 1-nerved, included within the 5th glume. Stamens 2. Styles distinct. Grain oblong, inclosed within the 5th glume and palea, free. Aromatic annual or perennial grasses, with flat leaves and narrow spike-like panicles.

Species 3 or 4. European.

FIG. 38. **Savastana odorata** (L.) Scribn. (*Hierochloë borealis* R. & S.). VANILLA-GRASS.—*a*, A spikelet showing the broad and nearly equal outer glumes; *b*, the same with the outer glumes removed, showing the scabrous 3d and 4th glumes; *c*, palea with stamens; *d*, the pistil. Figs. 84, of Bul. 7, and 410, of Bul. 17, illustrate other species of this genus.

38. **SAVASTANA** Schrank, Baier. Fl. I: 100, 337. 1789. (*Hierochloë* J. G. Gmelin. 1747). Spikelets 3-flowered, the terminal flower hermaphrodite, the others staminate; rachilla articulated above the empty glumes. Glumes 5; first two empty, nearly equal, and about the length of the spikelet, acute, smooth; the 3d and 4th about equaling the 1st and 2d in length, awnless or short-awned; the 5th inclosing a hermaphrodite flower, and becoming somewhat indurated in fruit. Palea nearly as long as the glume. Stamens in the male florets, 3; in the hermaphrodite flower, 2. Styles distinct, rather long, stigmas plumose. Caryopsis included in the upper glume, free. Fragrant, perennial grasses, with flat leaves, and usually rather small and pyramidal, terminal panicles.

Species about 10 or 12, in the cooler temperate and arctic regions of both hemispheres and high mountains within the tropics.

Tribe VIII.—AGROSTIDEÆ.

Spikelets all hermaphrodite, 1-flowered with 3 glumes, the first 2 empty (very rarely wanting), usually as long as or exceeding the 3d or floral glume; rachilla sometimes prolonged behind the palea into a naked or plumose bristle. Palea two-nerved (one-nerved in *Cinna*), nerveless, or (in some *Agrostis* species) wanting.

This is, next to the *Festuceæ*, the largest tribe in the order, numbering 700 species arranged in 46 genera. The species are distributed throughout all the temperate and colder regions of the world and many occur within the Tropics. The genus *Agrostis*, from which the tribe derives its name and from which comes the word "agrostologist," has about one hundred species, found in all parts of the world, especially in the north temperate zone. Some of our most important meadow grasses—notably Herd's-grass and timothy—belong to this tribe.

KEY TO THE GENERA OF THE AGROSTIDEÆ.

1. Flowering glumes awned or mucronate-pointed 2
1. Flowering glumes awnless 19

2. First empty glume with two to three awns, inflorescence a spike-like panicle..... 45. Lycurus
2. First empty glume with a single awn or awnless..... 3

3. Awn of the flowering glume terminal or from between the teeth of the bifid apex..... 4
3. Awns dorsal 13

4. Awns 3-branched or trifid, the lateral divisions sometimes very short ..... 39. Aristida
4. Awns simple or unbranched 5

5. Awns articulate with the apex of the flowering glume 6
5. Awns not articulate with the glume..... 8

6. Awns usually long, geniculate and twisted below, persistent or but tardily separating from the narrow and rigid flowering glume, which is tightly rolled around the grain in fruit; callus acute ..... 40. Stipa
6. Awns short, caducous or falling off soon after flowering 7

7. Flowering glume much firmer in texture than the empty ones, indurated at maturity, when it loosely envelops the grain. 41. ORYZOPSIS

7. Flowering glumes similar in texture to the empty ones, not indurated in fruit. (Section Vilfæ of *Sporobolus*, may be looked for here) ..... 53. EPICAMPES

8. Rachilla prolonged behind the palea 9

8. Rachilla not prolonged behind the palea 11

9. Awn terminal, long and straight, empty glumes minute. 44. BRACHYELYTRUM

9. Awn from between the teeth of the bifid apex of the flowering glume, short or reduced to a simple mucro 10

10. Callus of the flowering glume and prolongation of the rachilla naked; panicles loose or expanded ..... 57. CINNA

10. Callus and prolongation of the rachilla hairy; panicles dense and spike-like ..... 61. AMMOPHILA

11. Empty glumes none; spikelets minute in small umbel-like clusters ..... 49. SCHMIDTIA

11. Empty glumes two 12

12. Spikelets articulated with the pedicels below the firm and awnless empty glumes, falling off entire ..... 55. LIMNODEA

12. Spikelets not articulated with the pedicels below the empty glumes; flowering glumes 3-nerved and much firmer in texture than the empty ones, at least in fruit. (Section Vilfæ of *Sporobolus* may be looked for here) .. 43. MUHLENBERGIA

13. Spikelets articulated with the pedicels below the empty glumes, which are much longer than the flowering glume. 54. POLYPOGON

13. Spikelets not articulated with the pedicels below the empty glumes 14

14. Empty glumes saccate at the base, several times longer than the flowering glumes; inflorescence contracted and spike-like. 59. GASTRIDIUM

14. Empty glumes not saccate at the base, and if longer than the flowering glume, never exceeding it by more than one-third or one-half 15

15. Rachilla prolonged behind the palea 16

15. Rachilla not prolonged behind the palea 17

16. Callus of the flowering glume and prolongation of the rachilla hairy; empty glumes subequal; flowering glume dorsally awned ..... 60. CALAMAGROSTIS

16. Callus and prolongation of the rachilla naked; empty glumes unequal; flowering glume awned from the apex. 63. APERA

17. Empty glumes smooth or minutely scabrous along the keel. 58. AGROSTIS

17. Empty glumes more or less hairy and of about the same length as the flowering glumes..... 18

18. Empty glumes connate at the base; palea none; inflorescence a dense, cylindrical or oblong, spike-like panicle. 48. ALOPECURUS

18. Empty glumes distinct: palea present; inflorescence capitate, very woolly..... 64. LAGURUS

19. Flowering glumes flattened on the back, strongly indurated and shining ..... 42. MILIUM

19. Flowering glumes not flattened on the back nor strongly indurated 20

20. Rachilla prolonged behind the palea (the 1-flowered species of *Melica* may be looked for here) 21

20. Rachilla not prolonged 22

21. Empty glumes longer than the flowering glume; callus and prolongation of the rachilla hairy; panicle densely flowered, elongated, and spike-like ..... 61. AMMOPHILA

21. Empty glumes, or at least one of them, shorter than the flowering glume; callus and rachilla naked .. 56. ARCTAGROSTIS

22. Nerves of the flowering glume densely silky-villous nearly to the apex..... 52. BLEPHARONEURON

22. Nerves not densely silky-villous..... 23

23. Pericarp free or separable from the grain, sometimes opening at maturity; first empty glume usually shorter than the second and exceeded by the flowering glume . 51. SPOROBOLUS

23. Pericarp closely adherent to the grain 24

24. Flowering glumes hyaline, shorter and much more delicate in texture than the empty ones 25

24. Flowering glumes membranaceous, herbaceous, or chartaceous, not more delicate in texture than the empty ones..... 26

25. Empty glumes abruptly awn-pointed, the keels strongly ciliate. 47. PHLEUM

25. Empty glumes not abruptly awn-pointed, keels smooth or simply scabrous..... 58. AGROSTIS

26. Empty glumes minute, sometimes only one; stamen one. An arctic grass ..... 50. PHIPPSIA

26. Empty glumes conspicuous: stamens three..... 27

27. Panicles wholly or partially inclosed within the subtending leaf sheath, very rarely exserted 28
27. Panicles exserted; plants robust 29

28. Spikelets densely crowded in ovoid, or oblong spike-like panicles ..... 46. Heleochloa
28. Spikelets not densely crowded; panicles very narrow, simple and reduced to a few spikelets, or much elongated and many-flowered ..... 51. Sporobolus

29. Inflorescence an elongated, wand-like or spike-like panicle; empty glumes subequal, convex on the back; flowering glumes 3-nerved; callus naked ..... 53. Epicampes
29. Inflorescence a loose or expanded panicle; empty glumes unequal, compressed; flowering glumes 1-nerved; callus hairy ..... 62. Calamovilfa

FIG. 39. **Aristida oligantha** Mx. PRAIRIE TRIPLE-AWN.—*a*, The outer or empty glumes of a spikelet; *b*, a floret, showing the three widely-spreading awns. Figs. 85 to 88, in Bul. 7, and 413 to 422, in Bul. 17, illustrate other species of this genus.

39. **ARISTIDA** Linn. Sp. Pl. 82. 1753. Spikelets 1-flowered on long or short, slender pedicels, in terminal more or less expanded panicles; rachilla articulated above the empty glumes and produced into a hard obconical hairy callus below the floral glume, but not extending beyond it. Glumes 3: the first two empty, more or less unequal, acute or bristle-pointed, slightly keeled; the 3d or flowering glume firmer in texture than the outer ones, closely rolled around the flower and usually short palea, and terminating in a trifid awn. Grain slender, tightly inclosed by the hardened fruiting glume but free from it. Tufted narrow-leaved grasses, chiefly growing in dry, sandy, or sterile soil.

Species about 100, in all the warmer regions of the world. Some 40 species are recorded as growing within the United States, chiefly in the southern portions.

FIG. 40. **Stipa spartea** Trin. PORCUPINE-GRASS.—*a*, A single spikelet; *b*, a floret more highly magnified, showing the sharp-pointed, bearded callus at the base. **Figs. 90 and 91, in Bul. 7, and 423 to 440, in Bul. 17, illustrate other species of the genus *Stipa*.**

40. **STIPA** Linn. Sp. Pl. 78. 1753. Spikelets 1-flowered; rachilla articulated above the empty glumes and produced below the flowering glume into a strong, bearded, obconical, and sharp-pointed callus. Glumes 3, the first two empty, thin, membranaceous, subequal, acute or bristle-pointed, the 3d or floral glume narrow, subcoriaceous, closely rolled around the flower and usually shorter palea, terminating in a twisted and geniculate, simple awn which is articulated with its apex. Grain terete and closely enveloped by the hardened fruiting glume. Tufted perennial grasses with very narrow or involute leaves and usually open panicles.

Species about 100, widely distributed throughout the tropical and temperate regions of the world. About 30 species are recorded as occurring within the United States, chiefly Southwestern.

FIG. 41. **Oryzopsis juncea** (MX. B. s. P. *Oryzopsis canadensis* Torr. SMALL MOUNTAIN RICE.—*a*, Empty glumes; *b*, a floret showing the blunt callus at the base, the broad palea and short awn. Other species of this genus are illustrated by Figs. 92 to 97, in Bul. 7, and 441, in Bul. 17.

41. **ORYZOPSIS** Michx. Fl. Bor. Am. I : 51. 1803. *Eriocoma* Nutt. 1818. Spikelets 1-flowered, hermaphrodite; rachilla articulated above the empty glumes, and not produced behind the palea, usually extended below the flowering glume into a short and obtuse callus. Glumes 3, usually nearly equal, obtuse or acuminate-pointed; the 3d or flowering glume a little shorter or a little longer than the upper empty ones, rather broad, cartilaginous, or becoming coriaceous in fruit, and terminated by a slender, deciduous awn. Stamens 3. Styles distinct; stigmas plumose. Caryopsis free within the hardened fruiting glume. Slender, perennial grasses, with flat or convolute leaves, and loosely-flowered, spreading or narrow panicles.

Species about 15, in the north temperate zone of both hemispheres.

FIG. 42. **Milium effusum** L. WILD MILLET.—*a*, *b*, Spikelets; *c*, dorsal view of the flowering glume; *d*, anterior view of the same showing a portion of the nearly inclosed palea.

42. **MILIUM** Linn. Sp. Pl. 61. 1753. Spikelets 1-flowered; rachilla articulated above the empty glumes, not produced into a conspicuous callus nor extended above the flowering glume. Glumes 3, obtuse, awnless; the first two empty, subequal, membranous, convex; the 3d or flowering glume usually smooth and shining, becoming indurated in fruit; palea nearly as long as its glume. Stamens 3. Styles short, distinct; stigmas plumose. Grain ovoid or oblong, free within the hardened glume and palea. Annual or perennial grasses, with flat leaves and open panicles, differing from *Oryzopsis* in the obtuse and awnless flowering glume.

Species 5 or 6 in the temperate regions of Europe and Asia, 1 in North America.

FIG. 43. **Muhlenbergia sylvatica** Torr. WOODLAND DROP-SEED.—*a*, *b*, Spikelets; *c*, the same with the outer or empty glumes removed. Other species of *Muhlenbergia* are illustrated by Figs. 99 to 111, in Bul. 7, and 443 to 449, in Bul. 17.

43. **MUHLENBERGIA** Schreb. Gen. Pl. 44. 1789. Spikelets 1-flowered, hermaphrodite; rachilla articulated above the empty glumes, forming a very short and usually hairy callus below the floral glume, but not extending beyond it. Glumes 3, the first two empty, membranaceous or hyaline, 1- to 3-nerved or nerveless, usually unequal and shorter than the floral glume, acute, mucronate-pointed or sometimes awned; 3d or flowering glume narrow, smooth, or more or less pilose below, 3- to 5-nerved, awned from the acute apex, or from between the teeth of the more or less conspicuously bidentate apex. Awn straight or flexuose. Palea thin, 2-nerved, usually about the length of its glume. Stamens 3. Styles distinct. Grain closely enveloped by the fruiting glume. Perennial grasses (rarely annual) with small spikelets and greatly varying habit; culms a few inches to several feet high, simple or much-branched; leaves long or short, flat or strongly involute; panicle narrow and spike-like or open and widely spreading. Formerly included in *Agrostis*.

Species about 60, chiefly American; most abundant in Mexico

FIG. 44. **Brachyelytrum erectum** (Schreb.) Beauv. (*B. aristatum* R. & S.). BEARDED SHORT-HUSK.—*a*, A spikelet; *b*, the same with the awn and short empty glumes removed; *c*, empty glumes; *d*, palea.

44. **BRACHYELYTRUM** Beauv. Agrost. 39. 1812. Spikelets 1-flowered, hermaphrodite; rachilla articulated above the empty glumes, forming a short, usually smooth and rounded callus below the flowering glume, and prolonged behind the palea into a slender, naked bristle. Glumes 3, the first two empty, very small; the flowering glume herbaceous, rigid, 5-nerved, the narrow apex extending into a long straight awn. Palea 2-nerved, about equaling the glume. Stamens 2 (or 3). Styles short, distinct; stigmas elongated, plumose. Grain oblong, inclosed within the fruiting glume and palea. An erect perennial, with flat leaves and a narrow, few-flowered panicle.

Species 1, North American.

FIG. 45. **Lycurus phleoides** H. B. K. TEXAN TIMOTHY.—*a*, The empty glumes; *b*, the floret; *c*, the 2-awned lower empty glume.

45. **LYCURUS** H. B. K. Nov. Gen. et Sp. Pl. 1: 141, *t.* 45. 1815. (*Pleopogon* Nutt. Spikelets 1-flowered, usually in pairs. Empty glumes 2, 3-nerved, the nerves often produced into awns; flowering glume 3-nerved, awned, broader and longer than the empty ones. Palea a little smaller and more slender, 2-nerved, 2-keeled, very shortly 2-toothed. Stamens 3. Styles short, distinct; stigmas plumose. Grain included within the glumes, free. Caespitose, erect or ascending grasses, with narrow or often convolute leaves and cylindrical, usually densely flowered, spike-like, terminal panicles; the lower spikelet of each pair is often sterile.

Species 2 or 3, Southwestern States to Mexico.

FIG. 46. **Heleochloa schœnoides** (L.) Host. (*Crypsis schœnoides* Lam.). RUSH-LIKE TIMOTHY.—*a*, A spikelet; *b*, the same with the empty glumes removed; *c*, grain.

HELEOCHLOA Host, Gram. 46. 1 : 23, *t.* 29–30. 1801. (*Crypsis* Lam. 1791, not Ait. 1789. Spikelets 1-flowered, hermaphrodite, rachilla articulated above the empty glumes and not produced beyond the flower. Glumes 3, the first two empty, slightly unequal, membranaceous, acute, somewhat compressed, keeled, awnless; the 3d or flowering glume similar to the outer ones, but usually a little exceeding them in length. Palea shorter than its glume, hyaline, very faintly 2-nerved. Stamens 3. Styles distinct; stigmas plumose. Caryopsis loosely inclosed within the flowering glume, free. Usually low, densely caespitose, branching perennials, with oblong or ovoid, spike-like panicles, which are usually partially inclosed in the upper leaf sheath.

Species 7 or 8, in southern Europe and temperate Asia; one sparingly introduced in the Atlantic States.

FIG. 47. **Phleum pratense** L. TIMOTHY.—*a*, Empty glumes; *b*, the floret, showing 3 stamens and 2 stigmas. Fig. 451 in Bul. 17 illustrates another species of the genus *Phleum*.

47. **PHLEUM** Linn. Sp. Pl. 59. 1753. Spikelets 1-flowered, hermaphrodite; rachilla articulated above the empty glumes, not prolonged beyond the floret. Empty glumes 2, compressed-carinate, equal, usually ciliate on the keels and abruptly mucronate or short awn-pointed; floral glume shorter than the empty ones, thin, truncate, awnless, rather loosely inclosing the grain. Stamens 3. Styles distinct. Annual or perennial grasses, with simple, erect culms and dense, cylindrical or oblong, terminal spike-like panicles.

Species 10, in the temperate and cooler regions of the Old and New World. North American species 2, one of which, it is claimed, was originally introduced from Europe.

FIG. 48. **Alopecurus pratensis** L. MEADOW FOXTAIL.—*a*, A spikelet showing the connate, hairy empty glumes, 3 stamens and 2 styles; *b*, the same with the empty or outer glumes removed; the flowering glume is awned on the back. Figs. 115 and 117, in Bul. 7, and 452, in Bul. 17, illustrate other species of *Alopecurus*.

48. **ALOPECURUS** Linn. Sp. Pl. 60. 1753. Spikelets 1-flowered, strongly flattened; rachilla articulated below the empty glumes. Empty glumes 2, equal, awnless, more or less ciliate, especially along the keel, and usually connate at the base; flowering glume obtuse, hyaline, usually awned on the back, the margins near the base connate, forming a short tube. Palea none. Stamens 3. Styles usually distinct. Annual or perennial grasses, with erect or ascending culms, flat leaves, and densely-flowered cylindrical or ovoid, spike-like or capitate panicles.

Species about 20, in temperate Europe, Asia, Australia, and America. North American species, 5 or 6.

FIG. 49. **Schmidtia subtilis** Tratt. (*Coleanthus subtilis* Seid.). MOSS-GRASS.—*a*, *b*, Spikelets; *c*, palea.

49. **SCHMIDTIA** Tratt. Fl. Œsterr. 1 : 12. 1816. (*Coleanthus* Seid. 1817.) Spikelets 1-flowered. Outer empty glumes none; flowering glumes ovate, hyaline, keeled, usually bearing a short, straight awn. Palea 2-keeled, bifid, or 2- to 4-dentate. Stamens 2. Styles distinct; stigmas plumose. Caryopsis narrow, oblong, free. A small, annual grass, with short, flat leaves and small, umbel-like exserted panicles.

Species 1, Northern and Central Europe, Northern Asia, and Western North America.

FIG. 50. **Phippsia algida** (Soland.) R. Br.—*a*, *b*, Spikelets; *c*, empty glumes; *d*, flowering glume.

50. **PHIPPSIA** R. Br. Suppl. App. Parry's Voy. cclxxv. 1823. Spikelets 1-flowered, hermaphrodite, very small. Empty glumes minute, unequal, or the 1st sometimes wanting, the 3d or flowering glume thin, membranaceous, somewhat carinate, with the apex irregularly dentate, awnless. Palea about the length of its glume, 2-keeled. Stamen 1. Styles short, distinct; stigmas plumose. Caryopsis oblong, free. A dwarf annual, with narrow, flat leaves, which are scarcely exceeded by the very slender, few-flowered panicles.

Species 1, in the north polar regions of both hemispheres.

FIG. 51. **Sporobolus longifolius** (Torr.) Wood. LONG-LEAFED SPOROBOLUS.—*a*, A spikelet; *b*, the same with the outer or empty glumes separated from the flowering glume and palea; *c*, grain inclosed by the loose pericarp; *d*, grain. Other species of *Sporobolus* are illustrated by figs. 119 to 129, in Bul. 7, and 454 to 470, in Bul. 17.

51. **SPOROBOLUS** R. Br. Prod. Fl. Nov. Holl. 169. 1810. Spikelets 1-flowered, pedicellate, in narrow and spike-like or loose and spreading panicles; rachilla articulated above the empty glumes, not produced beyond the flower. Glumes 3; round on the back or slightly keeled, awnless, obscurely nerved, or nerveless; the 2 outer ones empty, usually unequal; 3d or floral glume equalling or exceeding the empty ones. Palea as long as or longer than the flowering glume. Stamens 3. Styles short, distinct. Grain free, the pericarp loosely inclosing the seed, or very thin and evanescent. Annual or perennial grasses with small spikelets; very various in habit.

Species about 80, a few in the Old World, but most abundant in America. Thirty-eight species have been recorded from the United States.

FIG. 52. **Blepharoneuron tricholepis** (Torr.) Nash. (*Vilfa tricholepis* **Torr.**).—*a*, Empty or outer glumes; *b*, the flowering glume and palea, both hairy.

52. **BLEPHARONEURON** Nash, Bull. Torr. Bot. Club **25**: 88. 1898. Spikelets 1-flowered, hermaphrodite. Empty glumes 1-nerved, glabrous, the 2d about as long as the flowering glume; flowering glume 3-nerved, the nerves densely pilose with long silky hairs for nearly their entire length, midnerve often shortly excurrent at apex. Palea as long as its glume, 2-nerved, densely pilose between the nerves. Stamens 3. Styles 2, distinct; stigmas plumose. Tufted perennial grasses with flat leaves and loosely-flowered open panicles.

Species 1 or 2, Southwestern States and Mexico. (The genus is based on *Vilfa tricholepis* Torr.)

FIG. 53. **Epicampes rigens** (Boland.) Benth. DEER-GRASS.—*a*, A spikelet: *b*, the same with the empty glumes removed; *c*, empty glumes with the floret above. **Fig. 131 in Bul. 7 illustrates another species of this genus.**

53. **EPICAMPES** Presl, Rel. Hænk. 1 : 235, *t.* 39. 1830. Spikelets small, 1-flowered. Empty glumes 2, membranaceous, slightly unequal, convex on the back, carinate, often finely 3-nerved; flowering glumes 3-nerved, obtuse or emarginate, a little shorter or about the length of the empty glumes, and tipped with a slender, usually rather short awn, which is rarely wanting. Stamens 3. Styles distinct, short: stigmas plumose. Grain included within the glumes, free. Tall, perennial grasses with usually very long, spike-like, many-flowered panicles.

Species about 16, chiefly Mexican and South American.

FIG. 54. **Polypogon monspeliensis** (L.) Desf. BEARD GRASS.—*a*, A spikelet; *b*, the same with the outer empty glumes removed; *c*, flower. Figs. 472 and 473 in Bul. No. 17 illustrate other species of this genus.

54. **POLYPOGON** Desf. Fl. Atl. I: 66. 1798. Spikelets 1-flowered, hermaphrodite. Glumes 3; 2 outer ones empty, nearly equal, usually broader above, entire or 2-lobed, awned, awn slender, straight; the 3d or flowering glume much smaller than the outer ones, usually thin and hyaline, entire, emarginate or bifid at the apex, awned; awn slender, straight, or geniculate and twisted below. Palea smaller than its glume. Stamens 1 to 3. Styles short, distinct; stigmas plumose. Caryopsis free. Usually annual grasses with decumbent, or rarely erect stems, flat leaves, and densely flowered terminal panicles.

Species about 10, in the warmer temperate regions of both hemispheres.

FIG. 55. **Limnodea arkansana** (Nutt.) Dewey.—*a*, A spikelet; *b*, the flowering glume and palea; *c*, a spikelet of *Limnodea arkansana* var. *pilosa*.

55. **LIMNODEA** Dewey in Contr. U. S. Nat. Herb. **2**: 518. 1894. (*Thurberia* Benth.; *Greenia* Nutt., not W. & A.) Spikelets 1-flowered, hermaphrodite. Empty glumes 2, rather rigid, subequal, awnless; the flowering glumes a little shorter than the empty ones, 2-cleft, or 2-toothed at the apex, awned between the teeth; awns slender, geniculate, flexuous or somewhat twisted toward the base. Palea a little shorter than the flowering glume, hyaline. Stamens 3. Styles short, distinct; stigmas shortly plumose. Grain narrow, oblong, included within the rigid fruiting glume, free. Slender, cæspitose, erect grasses, often decumbent at the base, with narrow, flat leaves and slender, terminal panicles; spikelets few or many, smooth or pubescent.

Species 2, North America in the Southwestern States.

FIG. 56. **Arctagrostis latifolia** (R. Br.) Griseb. (*Colpodium latifolium* R. Br.) BROAD-LEAFED ARCTIC BENT.—*a*, Empty glumes; *b*, floret showing the scabrous flowering glume and palea. Fig. 475 in Bul. 17 illustrates another species of *Arctagrostis*.

56. **ARCTAGROSTIS** Griseb. in Ledeb. Fl. Ross. **4**: 434. 1853. Spikelets 1-flowered, hermaphrodite. Empty glumes 2, slightly unequal, somewhat acute, membranaceous, awnless; the 3d or flowering glume usually a little longer than the outer ones, obtuse or subdentate at the apex, imperfectly 5-nerved, awnless, somewhat herbaceous in texture. Palea as long as its glume, obtuse or bidentate. Stamens 2 or 3. Styles distinct, very short; stigmas plumose. Caryopsis included within the glume and palea, free. A perennial cæspitose grass, with flat leaves and narrow, terminal panicle of rather large spikelets.

Species 1, in the arctic regions of North America and Europe.

FIG. 57. **Cinna arundinacea** L. INDIAN REED.—*a*, *b*, spikelets; *c*, same with the empty glumes removed. Figs. 476 and 477 in Bul. 17 illustrate other species of *Cinna*.

57. **CINNA** Linn. Sp. Pl. 5. 1753. Spikelets 1-flowered; rachilla distinctly articulated below the empty glumes as well as above them (the spikelets falling off entire), produced below the floret into a short and smooth stipe and usually extending behind the palea as a slender, naked bristle. Flowering glume similar to the outer ones, 3-nerved obtuse, usually with a very short, subterminal awn. Palea apparently 1-nerved, keeled. Stamens 1. Styles short, distinct. Grain included within the flowering glume and palea, free. Tall perennial grasses with numerous **flat leaves and many-flowered, nodding** panicles.

Species 3, in the northern regions of Europe and America

FIG. 58. **Agrostis alba** Linn. RED-TOP.—*a*, Empty glumes; *b*, floret inclosing stamens. Other species of *Agrostis* are illustrated by figs. 135 to 140, in Bul. 7, and 478 to 484, in Bul. 17.

58. **AGROSTIS** Linn. Sp. Pl. 6. 1753. Spikelets 1-flowered; rachilla articulated above the empty glumes, not produced beyond the flower. Empty glumes 2, equal or nearly so, acute, longer than the floret; flowering glume rather broad, less firm in texture than the outer glumes, usually obtuse, awnless, or with a slender dorsal awn. Palea hyaline, much shorter than the floral glume, or wholly absent. Stamens 3. Grain inclosed by the floral glume, but free from it. Annual or usually perennial grasses, with small spikelets in open, usually diffuse panicles.

Species about 100, distributed over the entire world, especially in the north temperate zone. In the United States the species are most numerous in the far Northwest.

FIG. 59. **Gastridium lendigerum** (L.) Gaudin. (*G. australe* Beauv.) NIT-GRASS.—*a*, A spikelet; *b*, the awned flowering glume; *c*, the same expanded.

59. **GASTRIDIUM** Beauv. Agrost. 21. *t. 6, f. 6.* 1812. Spikelets 1-flowered, hermaphrodite; rachilla prolonged behind the palea. Empty glumes 2, equal, enlarged, or saccate at the base, keeled above, much longer than the flowering glume; flowering glume hyaline, truncate, or obtusely 2-lobed, awnless, or bearing a slender awn just below the apex. Palea narrow, about the length of the glume. Stamens 3. Styles short, distinct; stigmas plumose. Grain subglobose, included within the ventricose base of the glumes, free. Cæspitose annuals with flat leaves, and shining, spike-like panicles.

Species 2, Southern and Western Europe, tropical Africa, and tropical America: 1 introduced into North America.

FIG. 60. **Calamagrostis langsdorffii** Trin. LANGSDORFF'S REED-BENT.—*a*, The empty glumes; *b*, floret; *c*, the plumose rudiment or prolongation of the rachilla. Figs. 142 to 148, in Bul. 7, and 485 to 494, in Bul. 17, further illustrate the genus *Calamagrostis*.

60. **CALAMAGROSTIS** Adans. Fam. Pl. **2**: 31. 1763. Spikelets 1-flowered; rachilla produced above the floret into a short, usually hairy pedicel or bristle. Glumes 3, the first two nearly equal and empty, awnless, and usually exceeding the 3d; 3d or floral glume usually more delicate in texture than the 1st and 2d, surrounded at the base with copious hairs which sometimes equal or exceed the glume in length, awned on the back usually from below the middle. Palea more than half the length of its glume, faintly 2-nerved. Stamens 3. Styles distinct. Grain inclosed by the floral glume and palea, and more or less adherent. Tall, often reed-like, perennial grasses with small spikelets in many-flowered, terminal panicles.

Species about 120, very widely distributed over the world in the temperate and arctic zones, and on high mountains within the tropics.

FIG. 61. **Ammophila arenaria** (L.) Link. (*A. arundinacea* Host). BEACH-GRASS, MARRAM-GRASS.—*a*, A single spikelet; *b*, the same with the empty glumes removed showing the hairy callus and short prolongation of the rachilla

61. **AMMOPHILA** Host Gram. Austr. **4**: 24, *t.* 41. 1809. Spikelets 1-flowered, hermaphrodite, rather large; rachilla produced beyond the floret into a short bristle, which is plumose above. Glumes 3, chartaceous, strongly compressed-keeled, awnless; the first two empty, acute, slightly unequal, and faintly 5-nerved; the 3d or flowering glume similar to the outer ones, slightly 2-toothed at the apex, and mucronate between the teeth. Palea as long as the floral glume, and of similar texture, 2-keeled, and deeply furrowed between the keels. Stamens 3. Styles distinct; stigmas plumose. Grain obovoid, loosely inclosed within the flowering glume and palea, free. A coarse, erect perennial, with creeping rhizomes, rigid culms and leaves, and narrow, densely-flowered, spike-like panicles.

Species 1, on the sandy seashores of Europe, the Atlantic coast of North America south to Virginia, and also on the shores of the Great Lakes.

FIG. 62. **Calamovilfa brevipilis** (Torr.) Scribn. SHORT-HAIRED REED-GRASS.—*a*, A spikelet; *b*, the same with the empty glumes removed. Fig. 495 in Bul. 17 illustrates another species of this genus.

62. **CALAMOVILFA** Scribn. in Hack. True Grasses, 113. 1890. Spikelets 1-flowered, hermaphrodite: rachilla articulated above the empty glumes, but not prolonged beyond the floret, callus densely bearded. Glumes 3, laterally compressed, keeled, chartaceous, awnless: the first two empty, unequal, acute, somewhat shorter than the flowering glume; flowering glume 1-nerved, acute. Palea as long as its glume. Stamens 3. Styles distinct; stigmas plumose. Grain loosely inclosed within the flowering glume and palea, free. **Rather tall, rigid perennials,** with loosely spreading panicles.

Species 2 or 3, in the United States.

FIG. 63. **Apera spica-venti** Beauv.—*a*, The empty glumes; *b*, the floret showing the long-awned flowering glume.

63. **APERA** Adans. Fam. Pl. **2**: 495. 1763. Spikelets 1-flowered, hermaphrodite, small; rachilla articulated above the empty glumes, and prolonged above flowering glume into a slender, naked bristle. Glumes 3; the first two empty, somewhat unequal; the 2d longer than the 1st thin-membranaceous, acute, awnless, and 3-nerved; flowering glume shorter than the outer ones, thin and nearly hyaline, shortly 2-toothed at the apex, awned; awn inserted just below the apex of the flowering glume and much exceeding it in length, straight or somewhat geniculate. Palea a little shorter than its glume, 2-keeled, 2-toothed. Stamens 3. Styles distinct, short; stigmas plumose. Caryopsis narrow, included in the fruiting glume, free. Annual grasses, with flat leaves and terminal, diffuse or contracted, many-flowered panicle.

Species 2, in Europe and Western Asia, 1 introduced into North America.

FIG. 64. **Lagurus ovatus** Linn.—*a*, The empty glumes; *b*, flowering glume and palea.

64. **LAGURUS** Linn. Sp. Pl. 81. 1753. Spikelets 1-flowered, hermaphrodite, in dense, capitate panicles. Empty glumes linear, long plumose-ciliate; flowing glume narrow, smooth, 2-cleft, the divisions prolonged into slender awns, the dorsal awn arising from above the middle, more rigid, longer, subgeniculate. Palea hyaline, 2-keeled. Stamens 3. Styles short, distinct; stigmas plumose. Grain narrow, free within the slightly rigid fruiting glume. A low annual with flat leaves and a long-exerted, ovoid, or oblong, solitary, densely flowered, and woolly panicles.

Species 1, Southern Europe. Cultivated as an ornamental and for dry bouquets.

Tribe IX.—AVENEÆ.

Spikelets 2-to several-flowered; outer empty glumes usually longer than the 1st floral glume; one or more of the flowering glumes awned on the back or from between the teeth of the bifid apex; awn usually twisted or geniculate; the callus, and usually the joints of the rachilla, hairy.

A tribe comprising 23 genera and over 300 species, widely distributed in the temperate regions of both the Old and the New World, particularly abundant in South Africa and Australia, a few extending beyond the arctic circle.

Several of the species are of economic value as forage plants. Tall meadow oat-grass (*Arrhenatherum elatius* (L.)) and Velvet grass or mesquite, as it is known in Oregon and Washington, both introduced from Europe, are grasses of much agricultural value, especially the first named. Tufted hair-grass (*Deschampsia cæspitosa* (L.)), a common grass in the Rocky Mountain region of the Northwest, is of some local value as a forage plant, especially for low wet soils. Cultivated oats, *Avena sativa*, used largely in the South and on the Pacific coast for pasturage and hay, and generally as a grain or cereal, is the best-known example of this tribe.

KEY TO THE GENERA OF THE AVENEÆ.

1. Rachilla not prolonged behind the palea of the upper floret, both flowers hermaphrodite ..... 66. Aira
1. Rachilla prolonged; spikelets 2-to several-flowered; when 2-flowered, one of the flowers usually staminate or imperfect. 2

2. Spikelets articulated with the pedicels below the outer glumes; the first floret hermaphrodite and awnless, the second staminate and awned ..... 65. Holcus
2. Spikelets not articulated with the pedicels below the outer glumes 3

3. Awns dorsal 4
3. Awns from between the teeth or divisions of the flowering glume and flattened near the base ..... 72. Danthonia

4. Spikelets 2-flowered, the first, or lower flower, staminate, its glume long-awned; the second hermaphrodite and usually awnless ..... 71. ARRHENATHERUM
4. Spikelets 2-to several-flowered, flowers all hermaphrodite or the uppermost imperfect 5

5. Awns articulated near the middle, the upper portion club-shaped ..... 67. WEINGÆRTNERIA
5. Awns not articulated, tapering to a point 6

6. Spikelets large, 1 centimeter ($\frac{1}{2}$ in.) or more in length; grain adherent to the glumes or palea, sulcate, hairy, at least at the apex. (Flowering glumes awnless in some cultivated forms)..... 70. AVENA
6. Spikelets less than 1 centimeter long; grain free from the glumes, not sulcate..... 7

7. Apex of the flowering glumes finely erose-dentate, 2-lobed or entire at the apex, rounded on the back, awned from below the middle..... 68. DESCHAMPSIA
7. Apex of the keeled flowering glumes 2-toothed, the teeth usually awn-like; awns arising from above the middle. (*Graphephorum melicoideum*, may be looked for here.) .... 69. TRISETUM

FIG. 65. **Holcus lanatus** L. VELVET-GRASS.—*a*, A spikelet; *b*, the same with the empty glumes removed, showing the curved awn of the second floret and curved joint of the rachilla below the first floret; *c*, upper portion of a sheath and lower portion of the leaf-blade.

65. **HOLCUS** Linn. Sp. Pl. 1047. 1753. Spikelets 2-flowered, the lower flower raised above the outer glumes upon a curved internode of the rachilla, hermaphrodite, awnless; the upper flower staminate (rarely hermaphrodite), its glume bearing an awn near the apex; rachilla articulated below the empty glumes and also below the floral glumes. Empty glumes nearly equal, compressed, boat-shaped, longer than the florets. Stamens 3. Annual or perennial herbs, with usually flat leaves and densely flowered terminal panicles.

Species about 8, in Europe and Africa; one species, *Holcus lanatus* L., often cultivated in meadows and lawns, has become widely dispersed.

FIG. 66. **Aira caryophyllea** L. SILVERY HAIR-GRASS.—*a*, A spikelet; *b*, the two awned florets. A second species of Aira is illustrated by fig. 153 in Bul. 7.

66. **AIRA** Linn. Sp. Pl. 63. 1753. Spikelets small, 2-flowered; flowers hermaphrodite; rachilla articulated below the flowering glumes and not produced beyond the upper one. Glumes thin-membranaceous, somewhat scarious; the first two persistent below the articulation of the rachilla, nearly equal, acute, awnless, longer than the flowering glumes; flowering glumes closely approximate, hyaline, mucronate or usually bidentate, awned on the back; awn usually geniculate, and twisted below. Palea a little shorter than the flowering glume, hyaline, 2-nerved. Caryopsis included within the hardened flowering glume and palea, and usually adherent to them. Delicate annual grasses, with narrow leaves and diffuse panicles.

Species 5 or 6, in Europe, North Africa, two introduced into the United States.

FIG. 67. **Weingærtneria canescens** Bernh.—*a*, A 2-flowered spikelet; *b*, a floret.

67. **WEINGÆRTNERIA** Bernh. Syst. Verz. Pfl. Erfurt, 51. 1800. (*Corynephorus* Beauv. 1812.) Spikelets 2-flowered, hermaphrodite, paniculate; rachilla articulated above the empty glumes, and prolonged beyond the florets as a small slender bristle. Empty glumes 2, thin, membranaceous, nearly equal, acute, awnless; flowering glumes shorter than the empty ones, hyaline, entire, awned upon the back below the middle; awn club-shaped at the apex, the upper portion articulated near the middle with the part below, a ring of short hairs marking the point of articulation. Palea a little shorter than the flowering glume, narrow, 2-toothed. Stamens 3. Styles short, distinct; stigmas plumose. Caryopsis inclosed in the thin fruiting glumes, and more or less adherent to them. **Annual grasses, with the habit of *Aira*.**

Species 2 or 3, European; one introduced into this country.

FIG. 68. **Deschampsia flexuosa** (L.) Trin. TUFTED HAIR-GRASS.—*a*, *b*, spikelets; *c*, floret from same. Figs. 154 to 158 in Bul. 7 illustrate other species of *Deschampsia*.

68. **DESCHAMPSIA** Beauv. Agrost. 91, *t. 18, f. 3.* 1812. Spikelets 2- (rarely 3-) flowered; rachilla hairy, articulated above the empty glumes and prolonged beyond the upper floret as a hairy bristle. Empty glumes 2, thin and scarious, acute or obtuse, nearly equal; flowering glumes subhyaline, 4-nerved, truncate, and more or less regularly 2- to 4-toothed, awned on the back; awn slender, twisted below. Palea narrow, 2-nerved. Grain oblong, included within the floral glume and palea, but free from them. Annuals or perennials, with flat or convolute leaves, and rather small, shining spikelets in terminal or lateral, narrow or loose panicles.

Species about 20, in the cold and temperate regions of the northern hemisphere and on the high mountains within the tropics; one in Australia: North American species, 9 or 10.

FIG. 69. **Trisetum subspicatum** (L.) Beauv. DOWNY OAT-GRASS.—*a*, A spikelet; *b* and *c*, florets. Figs. 159 to 164, in Bul. 7, and 496 to 498, in Bul. 17, illustrate other species of *Trisetum*.

69. **TRISETUM** Pers. Syn. 1 : 97. 1805. Spikelets 2- (rarely 3- to 5-) flowered, rachilla hairy or naked, articulated above the empty glumes and between the florets, produced beyond the upper flower as a (usually) hairy bristle. Empty glumes 2, awnless, carinate, unequal, usually longer than the floral glumes; flowering glumes subhyaline, carinate, cleft or 2-toothed at the apex, the teeth sometimes produced into slender awns, awned between or a little below the teeth; awn twisted and usually geniculate. Palea narrow, 2-toothed. Grain smooth, inclosed in the fruiting glume and palea, but free from them. Cæspitose perennials (rarely annuals) with flat leaves and dense and spike-like, or narrow, loose panicles.

Species 50, from the arctic regions through the temperate zone and along the high mountains of the tropics to the south temperate countries. North American species about 10.

FIG. 70. **Avena fatua** Linn. WILD OAT.—*a*, Empty glumes; *b*, a spikelet with the empty glumes removed. Figs. 165 and 166 in Bul. 7 also illustrate the genus *Avena*.

70. **AVENA** Linn. Sp. Pl. 79. 1753. Spikelets 2- to 6-flowered; rachilla articulated above the empty glumes, bearded below the flowering glumes. Empty glumes 2, unequal, membranaceous, longer than the flowering glumes; flowering glumes rounded on the back, 5- to 9-nerved, often bidentate at the apex, with a long, dorsal twisted awn. (The awn may be straight or even absent in cultivated forms). Grain pubescent, at least at the apex, frequently adhering to the fruiting glume or palea. Annuals or perennials with rather large spikelets variously paniculate.

Species about 50, widely spread over the temperate and cooler regions of the world. There are 2 or 3 native North American species, and 2 or 3 others, introduced from Europe, exist as weeds in some parts of the country.

FIG. 71. **Arrhenatherum elatius** (L.) Beauv. (*Avena elatior* L.). TALL OAT-GRASS.—*a*, A spikelet; *b*, the same with the empty glumes removed. The first floret is long-awned, while the second floret is short-awned or nearly awnless.

71. **ARRHENATHERUM** Beauv. Agrost. 55. 1812. Spikelets 2-flowered, the first or lower flower staminate, its glume bearing a twisted and geniculate awn on the back near the base; the upper flower hermaphrodite, its glume short-awned from or near the tip, or awnless; rachilla hairy, articulated above the empty glumes, and extending into a short point or bristle behind the palea of the upper flower. Empty glumes unequal, acute, their margins thin and scarious. Flowering glumes firmer in texture than the empty ones, 5-to 7-nerved, closely approximate. Palea prominently 2-nerved. Stigmas sessile. Usually tall perennials, with flat leaves and long, narrow panicles.

Species 5 or 6, in the Old World. One introduced and naturalized in the United States.

FIG. 72. **Danthonia compressa** Austin. TENNESSEE OAT-GRASS.—*a*, A spikelet; *b*, 1st empty glume; *c*, 2d empty glume; *d*, dorsal view of flowering glume; *e*, anterior view of same, showing palea; *f*, palea. Other species of *Danthonia* are illustrated by figs. 168 and 170 in Bul. 7.

72. **DANTHONIA** DC. in DC. and Lam. Fl. Franc. ed. 3. **3** : 32. 1805. Spikelets several-flowered, uppermost flower imperfect or rudimentary, rachilla articulated above the empty glumes. Empty glumes 2, much exceeding the flowering glumes, which are rounded on the back, 2-toothed or bifid at the apex, and awned between the teeth; awn formed by the extension of the 3 middle nerves of the glume. Inflorescence a simple, spreading or narrow panicle.

Species about 100, in the temperate and warmer regions of both hemispheres, especially numerous in South Africa. North American species, 6 or 7.

Tribe X.—CHLORIDEÆ.

Spikelets 1-to several-flowered in 1-sided spikes or racemes; the racemes digitate or fasiculate, rarely solitary; flowering glumes usually keeled, entire and unawned, or toothed, and with 1 or 3 (rarely more than 3) straight awns.

A small tribe of 27 genera and 155 species, characterized chiefly by the inflorescence, which is nearly that of *Paspalum*. The awns when present, are not dorsal or twisted, as in the *Agrostideæ* and *Aveneæ*. Chiefly natives of tropical and subtropical countries; a few are widely distributed as weeds throughout the warmer parts of the world. A number are good turf-forming grasses and are valued for grazing purposes. One of these is the celebrated buffalo-grass of the Western plains, which is remarkable for having the staminate and pistillate spikelets separate and in unlike inflorescences, either upon the same plant (monœcious) or upon different plants (diœcious). Bermuda-grass, and the Gramas of the South West belong to this tribe.

KEY TO THE GENERA OF THE CHLORIDEÆ.

1. Spikelets unisexual, dissimilar, the staminate and pistillate spikelets on the same, or on separate plants.. 85. Bulbilis
1. Spikelets all alike, hermaphrodite..... 2

2. Spike solitary; second empty glume with a stout, divergent awn on the back near the middle..... 75. Campulosus
2. Spikes rarely solitary; empty glumes not awned on back... 3

3. Spikelets articulated with the pedicels below the empty glumes 4
3. Spikelets not articulated with the pedicels; empty glumes persistent..... 5

4. Spikelets strongly compressed; empty glumes unequal keeled. 74. Spartina
4. Spikelets not much flattened; empty glumes equal, inflated and rounded on the back..... 81. Beckmannia

5. Spikelets strictly 1-flowered, without any prolongation of the rachilla, or, if prolonged, reduced to a simple rudiment without bracts or awns 6
5. Spikelets 2- to several-flowered, or with an awned, or bracteate prolongation of the rachilla 7

6. Spikes 2–6, digitate ..... 73. CYNODON
6. Spikes many, very slender and distant along a common axis. (*Bouteloua uniflora* may be looked for here.)
79. SCHEDONNARDUS

7. Spikelets with 1 hermaphrodite floret, and 1 to several empty glumes or awns above 8
7. Spikelets with 2 to several hermaphrodite florets 11

8. Spikes digitate or closely approximate, occasionally in apparent whorls 9
8. Spikes remote, or the lowest only approximate 10

9. Flowering glume of the perfect flower with a single awn, or awnless ..... 76. CHLORIS
9. Flowering glume of the perfect flower with 3 awns.
77. TRICHLORIS

10. Spikelets remote; upper sterile glumes reduced to simple awns.
78. GYMNOPOGON
10. Spikelets crowded; prolongation of the rachilla triaristate.
80. BOUTELOUA

11. Spikes few, stout 12
11. Spikes slender, usually numerous 13

12. Axis of the spikes terminated by a spikelet; empty glumes awnless ..... 82. ELEUSINE
12. Axis of the spikes projecting beyond the spikelets; empty glumes, at least the second one, strongly mucronate or awn-pointed ..... 83. DACTYLOCTENIUM

13. Spikes crowded or fasciculate near the apex of the culms, flowering glumes long awned ..... 77. TRICHLORIS
13. Spikes alternating and more or less remote along the common axis; flowering glumes narrow, entire, or 2-toothed, awned or awnless ..... 84. LEPTOCHLOA

FIG. 78. **Cynodon dactylon** (L.) Pers. (*Capriola dactylon* Kuntze; *Panicum dactylon* L.). BERMUDA-GRASS.—*a*, A spikelet; *b*, the same with the outer or empty glumes removed, showing the rachilla *b'*.

73. **CYNODON** Pers. 1805. Spikelets 1-flowered, awnless, sessile in 2 rows along one side of a slender, continuous axis, forming unilateral spikes; rachilla articulated above the empty glumes and prolonged behind the palea of the hermaphrodite floret into a slender, naked bristle. Glumes 3, the 1st two narrow, keeled, usually acute, empty; the 3d or floral glume broader and usually a little longer than the empty ones, obtuse, more or less pilose on the keel and at the margins. Palea about the length of its glume, 2-keeled. Stamens 3. Styles distinct. Grain free within the fruiting glume and palea. Low, creeping perennials, with short flat leaves and slender spikes digitate at the apex of the upright branches.

Species 4, one distributed throughout the tropical and warmer temperate regions of the world, the others South American and Australian.

FIG. 74. **Spartina cynosuroides** (L.) Willd. FRESHWATER CORD-GRASS.—*a*, A spikelet showing the exserted stamens; *b*, a spikelet with the stigmas exserted; *c*, the same with the empty glumes removed. Figs. 172 to 177 in Bul. 7 illustrate other species of *Spartina*.

74. **SPARTINA** Schreb. Gen. Pl. 43. 1789. Spikelets 1-flowered, strongly flattened laterally, sessile, and closely imbricated in 2 rows along one side of a continuous rachis, forming unilateral spikes, which are scattered along a common axis; rachilla articulated below the empty glumes and not produced beyond the floret. Glumes 3, the 1st two empty, keeled, acute, or bristle-pointed, unequal, the 2d as long as or often exceeding the 3d or flowering glume. Stamens 3. Styles elongated, filiform. Grain narrow, free within the glume and palea. Coarse perennials, with strong, creeping rootstocks, rigid culms, and long, tough leaves.

Species 7, extratropical North and South America and along the coasts of Europe and Africa; chiefly maritime, or in the saline regions of the Great Plains.

FIG. 75. **Campulosus aromaticus** (Walt.) Trin. (*Ctenium americanum* Spreng.). TOOTHACHE-GRASS.—*a*, Empty glumes of a spikelet; *b*, a spikelet with the outer empty glumes removed. Fig. 179 in Bul. 7 illustrates another species of *Campulosus*.

75. **CAMPULOSUS** Desv. Nouv. Bul. Soc. Philom., **2**: 189. 1810. (*Ctenium* Panzer 1814.) Spikelets 2- to 5-flowered; the lower hermaphrodite, the others staminate or imperfect; rachilla articulated above the empty glumes. Empty glumes 2, at the base of the spikelets, unequal; the 1st small and sub-hyaline, the 2d larger, somewhat rigid, acute, or shortly 2-toothed, with a stout divergent awn on the back; glume of the hermaphrodite flower with a very slender awn below the apex and densely ciliate toward the base, 3-nerved. Stamens 3. Styles distinct; stigmas plumose. Rather tall grasses, with narrow leaves, and usually solitary, terminal, more or less curved, one-sided spikes.

Species 11, eight American, the others in the Eastern Hemisphere.

FIG. 76. **Chloris elegans** H.B.K. (*C. alba* Presl.).—*a*, The empty or outer empty glumes of a spikelet; *b*, the florets raised above the empty glumes; *c*, a palea.

76. **CHLORIS** Swartz, Prodr. Fl. Ind. Occ. 25. 1788. Spikelets 1-flowered, awned, sessile in 2 rows along one side of a continuous rachis, forming unilateral spikes; rachilla articulated above the empty glumes and produced behind the palea, bearing 1 or more rudimentary awned empty glumes. Outer empty glumes 2, unequal, lanceolate, acute, somewhat keeled; flowering glume narrow or broad, 1- to 3-nerved, acute, or broadly obtuse, truncate, emarginate or 2-lobed at the apex, often ciliate on the back or margins, the middle nerve nearly always prolonged into a slender awn. Grain free within the fruiting glume. Usually perennial grasses, with flat leaves and showy or attractive inflorescence of two to many digitate spikes.

Species about 40, widely distributed throughout the warmer countries of the world. Several are cultivated for ornament.

FIG. 77. **Trichloris fasciculata** Fourn.—*a*, *b*, The empty glumes of 2 spikelets; *c*, a view of the first floret showing the rudimentary second floret; *d*, dorsal view of the first floret which is terminated by 3 long awns. One other species of this genus is illustrated by fig. 190 in Bul. 7.

77. **TRICHLORIS** Fourn. Mex. Pl. **2**: 142. 1881. Spikelets 1- to 3-flowered, hermaphrodite, sessile in two series along the continuous rhachis of the unilateral spikes; rachilla articulated above the empty glumes and prolonged above the hermaphrodite flowers, terminating in an awned rudimentary floret. Lower empty glumes 2, unequal, 1-nerved, thin-membranaceous, the 2d short-awned; flowering glume membranaceous, 3-nerved, 3-awned; awns erect, subequal, or the lateral ones much shorter. Palea closely enveloped by the glume, hyaline, 2-keeled. Stamens 3. Styles distinct; stigmas plumose. Grain narrow, oblong, subterete, free within the glumes. Rather tall perennial (?) grasses with flat leaves and many slender spikes, which are digitate or closely approximate at the apex of the culm, forming dense oblong panicles.

Species 2 or 3, Texas, Arizona, Mexico, and South America.

FIG. 78. **Gymnopogon ambiguus** (Michx.) B. S. P. (*G. racemosus* Beauv.). NAKED BEARD-GRASS.—*a*, A spikelet; *b*, the empty glumes; *c*, a spikelet with the empty glumes removed. Fig. 192 in Bul. 7 illustrates a second species of this genus.

78. **GYMNOPOGON** Beauv. Agrost. 41 *t. 9. f. 5.* 1812. **Spikelets 1-flowered,** subsessile, rather distant along one side of a slender filiform rachis, forming slender unilateral spikes; rachilla articulated above the empty glumes and produced beyond the floret as a slender, and usually awned rudiment. **Empty** glumes 2, very narrow, subequal, as long as or longer than the floral glumes; flowering glume broader, 3-nerved, bearing a slender, straight awn below **the 2-cleft apex. Grain** inclosed within the rigid fruiting glume, free. **Perennial grasses, with short,** rather broad and rigid leaves and numerous slender spikes which are at first erect, finally divaricate spreading or reflexed.

Species 6, one in Ceylon, the others American. Two species in the **Eastern and Southern States.**

FIG. 79. **Schedonnardus paniculatus** (Nutt.) Trelease. TEXAN CRAB-GRASS.—*a*, A portion of the axis of a spike bearing 3 spikelets; *b*, a single spikelet; *c*, the flowering glume; *d*, palea.

79. **SCHEDONNARDUS** Steud. Syn. Pl. Gram. 146. 1854. Spikelets 1-flowered, hermaphrodite, sessile, and scattered along one side of the slender rachis of the widely spreading spikes; rachilla articulated above the empty glumes. Empty glumes narrow, slightly unequal, membranaceous; flowering glumes longer than the empty ones, membranaceous, becoming somewhat rigid, acuminate-pointed, or minutely mucronate at the apex. Stamens 3. Styles distinct; stigmas plumose. Caryopsis inclosed within the rigid fruiting glumes and palea, but free. A low, diffusely branching annual, with short, narrow leaves and slender paniculate spikes.

Species 1, in western North America.

FIG. 80. **Bouteloua oligostachya** (Nutt.) Torr. BLUE GRAMA.—*a*, The empty glumes of a spikelet; *b*, a spikelet with the empty glumes removed, showing the 3-awned flowering glume, its palea, and the pedicellate 3-awned rudiment. Figs. 194 to 207, in Bul. 7, and 500 to 502, in Bul. 17, illustrate other species of this genus.

80. **BOUTELOUA** Lag. Varied. Ciene. Litt. Art. **2**: 141. 1805. Spikelets 1-to 2-flowered, numerous (rarely 2 or 3 or only 1), crowded and closely sessile in 2 rows along one side of a continuous flattened rachis, which usually projects beyond the spikelets; rachilla articulated above the empty glumes, the continuation beyond the hermaphrodite lower floret usually bearing a few rudimentary glumes and 3 awns (rarely a staminate flower). Empty glumes 2, unequal, the lower smaller, keeled; flowering glume broader, 3-nerved, 3-to 5-toothed, or cleft, 3 of the divisions usually mucronate or awn-pointed. Palea 2-nerved and 2-toothed. Grain inclosed within the glume, but free. Usually low annuals or perennials, with narrow and flat or convolute leaves, the unilateral spikes few or many (rarely solitary), and nearly sessile along a common axis.

Species about 30, all American, most abundant in the Southwestern States.

FIG. 81. **Beckmannia erucæformis** (L.) Host. SLOUGH-GRASS.—*a*, A portion of a branch of the inflorescence showing the crowded, imbricate spikelets; *b*, a dorsal view of the same; *c*, a spikelet; *d*, flowing glume.

81. **BECKMANNIA** Host Gram. **3:** 5. *t.* 6. 1805. Spikelets 1- to 2-flowered, rather broad, compressed, closely imbricated in 2 rows along one side of the rachis of the short spikes; rachilla articulated below the empty glumes. Empty glumes 2, inflated, boat-shaped, obtuse or abruptly pointed, nearly equal; flowering glumes narrow, rather firmer in texture than the empty ones, and acute or mucronate-pointed. Palea hyaline, 2-keeled, nearly as long as the glume. Stamens 3. Styles short, distinct, stigmas plumose. Caryopsis oblong, inclosed within the rigid fruiting glume and palea, free. A rather tall, erect grass, with flat leaves, and a terminal, elongated inflorescence, somewhat resembling that of *Panicum colonum*.

Species 1, northern **Europe, Asia, and North America.**

FIG. 82. **Eleusine indica** (L.) Gærtn. GOOSE- or YARD-GRASS.—*a*, A portion of the axis of a spike bearing 3 spikelets, one of which is terminal; *b*, a single spikelet; *c*, a floret; *d*, the seed.

82. **ELEUSINE** Gærtn. Fruct. et Sem. I: 7, *t.* 1. 1788. Spikelets several-flowered, sessile, and closely imbricated in 2 rows along 1 side of a continuous rhachis, which does not project beyond the terminal spikelet; rachilla articulated above the empty glumes. Glumes compressed, keeled, thin, but rigid, obtuse, the 1st 2 and sometimes the uppermost 1 empty. Palea a little shorter than the glume, compressed, bicarinate. Seed finely striated and inclosed within a thin pericarp. Coarse-tufted annuals, with the rather stout unilateral spikes digitate or approximate at the apex of the culm.

Species 5 or 6, in tropical and subtropical regions of the Old World. *E. coracana* is valued in Africa, India, and some other eastern countries as a cereal. The species here illustrated is a common weed in all the warmer countries of the world.

FIG. 83. **Dactyloctenium aegyptium** (L.) Willd. CROWFOOT-GRASS.—*a*, A spikelet; *b*, 2 florets, the upper one rudimentary or imperfect; *c*, stamens; *d*, the second empty glume.

83. **DACTYLOCTENIUM** Willd. Enum. Hort. Berol. 1029. 1809. Spikelets several-flowered, the uppermost imperfect, sessile, and crowded in 2 rows along one side of a continuous axis, forming unilateral spikes, these digitate at the apex of the culm; rachilla articulated above the empty glumes and between the florets. Glumes compressed laterally, keeled, the first 2 empty, the 2d awn-pointed; flowering glumes boat-shaped, mucronate-pointed. Fruit a utricle, the thin pericarp loosely inclosing the wrinkled, globular seed. Annual, with a more or less decumbent and creeping base and 2 to 6 terminal stout spikes, the rhachis projecting beyond the spikelets.

Species 2, one a weed in all the warmer countries of the world.

FIG. 84. **Leptochloa mucronata** (Michx.) **Kunth. FEATHER-GRASS.**—*a*, The empty outer glumes of a spikelet; *b*, a spikelet with the outer glumes removed. Figures 211 to 218 in Bul. 7 illustrate other species of the genus.

84. **LEPTOCHLOA** Beauv. Agrost. 71, *t. 15, f. 7.* 1812. Spikelets 2- to several-flowered, sessile, in 2 rows along one side of the slender and often numerous branches of a simple panicle; rhachilla articulated above the empty glumes. Empty glumes 2-keeled, awnless or very short-awned; flowering glumes keeled, 3-nerved, acute, awnless or very short-awned, or 2- to 3-toothed, mucronate or short-awned between the teeth. Palea 2-keeled. Usually tall annuals, with flat leaves and elongated simple panicles made up of the numerous and more or less spreading slender spikes scattered along the main axis.

Species about 20, in the warmer countries of both hemispheres. In the United States the species are mostly southwestern.

FIG. 85. **Bulbilis dactyloides** (Nutt) Raf. (*Buchloë dactyloides* Engelm.). BUFFALO-GRASS.—*a*, A female or fruiting plant; *a'*, the pistillate or female inflorescence; *b*, a male or staminate plant; *b'*, the staminate or male inflorescence; *c*, a staminate spikelet.

85. **BULBILIS** Raf. Am. Month. Mag. **4** : 190. 1819. (*Buchloe* Engelmann. 1859.) Staminate spikelets 2- to 3-flowered, sessile, in 2 rows along the short one-sided spikes. Empty glumes obtuse, unequal; flowering glumes larger, 3-nerved. Palea a little shorter than its glume, 2-nerved. Stamens 3. Pistils none. Pistillate spikelets 1-flowered, in a nearly capitate, one-sided spikes, which are scarcely exserted from the broad sheaths of the upper leaves. Empty glumes 2, the 1st sometimes wanting, the outer one large, concave at the base, or in the lowest spikelet connate with the nearly equal 1st glume, indurated, apex 3-toothed; flowering glume narrow, hyaline, entire or bifid at the apex, inclosing the 2-nerved palea. Stamens none. Styles distinct, with elongated plumose stigmas. Grain free within the hardened empty glumes. A creeping or stoloniferous perennial, with narrow, flat leaves, and dissimilar staminate and pistillate flowers borne on the same or on distinct plants.

Species 1, western North America.

Tribe XI.—FESTUCEÆ.

Spikelets 2-to many-flowered, usually hermaphrodite, pedicellate in racemes or panicles, the latter sometimes dense and spike-like; flowering glumes usually longer than the empty ones, awnless or with one to several straight (rarely bent) awns which are either terminal or borne just below the apex.

This is the largest tribe in the order, numbering 76 genera and about 725 species. It contains the most important meadow grasses of the temperate regions as well as the more prevalent grasses of the higher mountains within the tropics. The genus *Poa*, which includes Kentucky blue grass, Texas blue grass, etc., numbers 100 species, and an equal number of species are included in the genus *Eragrostis*. The Fescues number 80 species, and the tribe takes its name from this genus—*Festuca*. Orchard grass, *Dactylis glomerata*, is a well-known example of this tribe.

KEY TO THE GENERA OF THE FESTUCEÆ.

1. Flowering glumes with 9–23 awn-like divisions, or awned lobes 2
1. Flowering glumes with fewer lobes, or entire 3

2. Panicle narrow and spike-like; divisions of the flowering glumes awn-like and plumose ..... 86. Pappophorum
2. Panicle expanded; divisions of the flowering glumes membranaceous, awn-pointed ..... 87. Cottea

3. Spikelets unisexual, the two sexes very unlike; glumes of the pistillate flowers 3-awned, those of the staminate flowers awnless ..... 89. Scleropogon
3. Spikelets hermaphrodite, or if unisexual, those of the two sexes similar 4

4. Spikelets in groups of three along a common axis, the groups readily deciduous as a whole; flowering glumes four-parted, awned between the divisions ..... 88. Cathestecum
4. Spikelets not in deciduous groups or fascicles 5

5. Spikelets of two kinds in the same inflorescence, hermaphrodite and sterile 6
5. Spikelets all alike in the same inflorescence 7

6. Fertile spikelets 2–3-flowered, awnless; the sterile with numerous awned or awn-pointed glumes..... 115. CYNOSURUS
6. Fertile spikelets 1-flowered, long-awned; the sterile with many obtuse glumes ..... 116. LAMARCKIA

7. Plants diœcious 8
7. Plants not diœcious 11

8 Spikelets solitary, concealed in the axils of the crowded, short, and rigid leaves..... 90. MONANTHOCHLOË
8. Spikelets in exserted panicles 9

9. Flowering glumes 3-nerved, subulate, the midnerve extending into a fine awn. Tall reed-like grass..... 93. GYNERIUM
9. Flowering glumes 5- to many-nerved, broad, ovate, or oblong, awnless..... 10

10. Flowering glumes many-nerved, coriaceous; spikelets few in short, spike-like panicles ..... 112. DISTICHLIS
10. Flowering glumes 5-nerved, herbaceous or chartaceous. 117. POA

11. Empty glumes 3 to 6 below the first flowering glume..... 12
11. Empty glumes 2, or rarely only 1, below the first flowering glume 13

12. Third and fourth glumes similar to the first and second, all awnless. Tall grasses with strongly compressed spikelets. 111. UNIOLA
12. Third and fourth glumes very unlike the first and second, 3-nerved and 3-awned. Low, desert grasses. 96. BLEPHARIDACHNE

13. Rachilla or flowering glumes clothed with long hairs exceeding the glumes in length. Tall, reed-like grasses 14
13. Rachilla or flowering glumes naked or with hairs shorter than the glumes 16

14. Leaves narrow and very long, chiefly radical; culms solid. 93. GYNERIUM
14. Leaves broader, chiefly cauline; culms hollow 15

15. Hairs on the rachilla only..... 95. PHRAGMITES
15. Hairs on the flowering glumes, the rachilla naked. 94. ARUNDO

16. Culms dichotomously branched; leaves crowded in dense fascicles at the nodes or ends of the branches.. 91. MUNROA
16. Culms not dichotomously branched; leaves not in dense fascicles 17

17. Spikelets sessile in short terminal spikes; flowering glumes many-nerved ..... 92. ORCUTTIA
17. Spikelets in racemes or panicles, these sometimes narrow and spike-like 18

18. Flowering glumes 1- to 3-nerved or nerveless 19
18. Flowering glumes 5- to many-nerved 29

19. Callus or base of the flowering glume hairy or barbate 20
19. Callus or base of the flowering glume glabrous 23

20. Hairs extending more or less along the prominent nerves.. 21
20. Hairs not extending along the nerves; the glumes glabrous.. 22

21. Flowering glumes tridentate (rarely entire), the 3 nerves, or at least the middle one, prolonged between the teeth as mucros or very short awns ..... 97. TRIODIA
21. Flowering glumes deeply 3-cleft, the lateral divisions narrow, the central one prolonged and awn-like ..... 99. TRIPLASIS

22. Flowering glumes chartaceous, densely hairy on the callus, nerves conspicuous. Tall grasses with ample, capillary panicles ..... 100. REDFIELDIA
22. Flowering glumes thin-membranaceous, hairs on the callus few and short; nerves obscure ..... 118. COLPODIUM

23. Empty glumes much longer than the flowering glumes. 101. DISSANTHELIUM
23. Empty glumes shorter than or not much exceeding the flowering glumes 24

24. Flowering glumes coriaceous, shining, rounded on the back and subulate pointed; 2 to 4 of the upper glumes empty. 109. KORYCARPUS
24. Flowering glumes not coriaceous 25

25. Spikelets subterete; flowering glumes rounded on the back; empty glumes much shorter than the flowering glumes. 102. MOLINIA
25. Spikelets compressed; flowering glumes keeled, or, if rounded on the back, not much larger than the empty glumes... 26

26. Empty glumes nearly equal in length, but very unlike, the first narrowly linear and 1-nerved, the second broadly obovate, obtuse, and 3-nerved ..... 104. EATONIA
26. Empty glumes more or less unequal in length, but similar in shape 27

27. Flowering glumes falling with the grain in advance of the paleas, which remain for a time attached to the continuous rachilla; spikelets usually many-flowered.. 103. ERAGROSTIS
27. Flowering glumes and paleas falling together, carrying with them a joint of the articulate rachilla 28

28. Empty glumes obtuse, much shorter than the obtuse or imperfectly 3-toothed flowering glumes..... 106. CATABROSA
28. Empty glumes acute, nearly equaling or as long as the acute, or very short-awned flowering glumes..... 105. KŒLERIA

29. Spikelets nearly sessile in dense one-sided clusters at the ends of the few panicle branches; flowering glumes strongly compressed-keeled, the keel extending into a short point or awn..... 114. DACTYLIS
29. Spikelets not in dense one-sided clusters at the ends of the panicle branches..... 30

30. Keels of the palea with a distinct crest or wing-like appendage; flowering glume 7-nerved, the mid-nerve slightly prolonged beyond the entire or emarginate apex; inflorescence a simple raceme..... 110. PLEUROPOGON
30. Keels of the palea not winged..... 31

31. Spikelets somewhat heart-shaped; flowering glumes cordate at the base, many-nerved, strongly rounded on the back, becoming ventricose. (*Bromus brizæformis* may be looked for here)..... 113. BRIZA
31. Spikelets not heart-shaped; flowering glumes not cordate at base..... 32

32. Flowering glumes very broad, fan-shaped (flabelliform), thin-membranaceous, obscurely few- to many-nerved; spikelets crowded in short, spike-like panicles.... 108. ANTHOCHLOA
32. Flowering glumes not broad fan-shaped..... 33

33. Callus barbate or pilose. (Some species of *Poa* may be looked for here)..... 34
33. Callus naked..... 38

34. Rachilla and callus both pilose-hairy, hairs 1–2 mm. long; second glume acute, nearly as long as the spikelet; flowering glume, with a very short awn just below the bidentate apex or awnless..... 121. GRAPHEPHORUM
34. Rachilla and callus naked or nearly so..... 35

35. Nerves of the flowering glumes 5–9, manifest..... 36
35. Nerves of the flowering glumes 3–5, indistinct or obsolete.. 37

36. A low, slender grass with strict, few-flowered panicles, 2–4 cm. long; flowering glumes pilose on the margins, smooth and rounded on the back, subcoriaceous, tridentate at the rather broad apex..... 98. SIEGLINGIA
36. A tall, stout grass 9–15 dm. high, with ample, open panicles 16–30 cm. long; flowering glumes glabrous on the margins, apex erose-dentate..... 120. SCOLOCHLOA

37. Panicles erect, strict, or with the rigid branches widely divergent; hairs on the callus few; nerves of flowering glumes obsolete ..... 119. DUPONTIA
37. Panicles nodding, the spreading branches usually capillary. 118. COLPODIUM

38. Flowering glumes rounded on the back 39
38. Flowering glumes compressed-keeled 45

39. Nerves of the flowering glumes prominent 40
39. Nerves of the flowering glumes obscure or manifest only near the apex 42

40. Flowering glumes long-attenuate pointed or awned. (Some species of *Bromus* may be looked for here) ... 107. MELICA
40. Flowering glumes awnless, usually broad and obtuse (acuminate in *Panicularia acutiflora*) 41

41. Spikelets with 1- to several club-shaped or hooded empty glumes above the fertile florets ..... 107. MELICA
41. Spikelets without club-shaped or hooded glumes above the perfect floret; outer empty glumes scarious and much shorter than the flowering glumes ..... 122. PANICULARIA

42. Flowering glumes obtuse, awnless 43
42. Flowering glumes acute, often awned 44

43. Empty glumes usually small and decidedly shorter than the flowering glumes. Low grasses of the seashore or alkali plains of the interior ..... 123. PUCCINELLIA
43. Empty glumes usually about as long as the nearest flowering glume, the latter often scabrous or more or less pubescent. 117. POA

44. Flowering glumes entire, acute, or awned from the apex, 5-nerved ..... 124. FESTUCA
44. Flowering glumes obtuse, usually awned just below the entire or 2-toothed apex; styles inserted below the hairy apex of the ovary ..... 125. BROMUS

45. Spikelets 1–2 cm. ($\frac{1}{2}$–1 in.) or more long, short-awned (nearly awnless) from the entire or 2-toothed apex; grain adnate to the palea ..... 125. BROMUS
45. Spikelets smaller, very rarely 1 cm. long, awnless; flowering glumes 5-nerved, often hairy or pubescent on the nerves below, and with (or without) a tuft of long cobwebby hair at the base ..... 117. POA

FIG. 86. **Pappophorum wrightii** S. Wats. PURPLE-GRASS.—*a*, A spikelet; *b*, the same with the outer glumes removed; *c*, the flowering glume of the perfect floret flattened out and seen from the back; *d*, palea. Fig. 222 in Bul. 7 illustrates a second species of this genus.

86. **PAPPOPHORUM** Schreb. Gen. Pl. **2**: 787. 1791. Spikelets 1–2-, rarely 3-flowered; rachilla articulated above the lower glumes, 1–2-flowered, hermaphrodite, the uppermost often staminate. Lower empty glumes 2, persistent, membranaceous, acute, carinate, nerveless on the sides or with 1–3 nerves on each side; flowering glumes broad at base, subcoriaceous, obscurely many-nerved, unequally divided into 9–23 awn-like lobes; upper 2–3, narrower, empty, or one or the other inclosing a palea or rudiment of a flower; palea included in the flowering glume, rather broad, 2-carinate near the margins, sometimes exceeding the entire part of the glume. Perennial (or rarely annual?) cæspitose grasses, with narrow, usually convolute leaves, dense, spike-like panicles, often somewhat interrupted; awns usually plumose.

Species about 20, in tropical and subtropical regions of both hemispheres, 3 in our Southwestern States and Territories, extending southward into Mexico.

FIG. 87. **Cottea pappophoroides** Kth. COTTA GRASS.—*a*, The empty glumes of a spikelet; *b*, a floret seen from the side; *c*, dorsal view of a flowering glume; *d*, palea; *e*, caryopsis.

87. **COTTEA** Kunth, Rev. Gram. 1: 84. 1835. Spikelets many, 2- to 6-flowered; rachilla articulated above the empty glumes; flowers hermaphrodite, or the uppermost staminate, usually imperfect. Outer glumes empty, persistent, membranaceous, acute or tridentate, 7- to 9-nerved; flowering glumes 9- to 11-nerved, and irregularly 9- to 11-lobed, the divisions erect and for the most part awn-like. Palea rather broad, 2-keeled, somewhat exceeding the undivided portion of the glumes. An erect, branching grass, with linear flat leaves, and oblong, open panicles.

Species 1, Texas to Arizona and southward.

FIG. 88. **Cathestecum prostratum** Presl.—*a*, A group of 3 spikelets; *b*, a single spikelet; *c*, the outer empty glume; *d*, inner empty glume; *e* and *g*, flowering glumes; *f*, a palea.

88. **CATHESTECUM** Presl, Rel. Haenk. 1: 294, *t.* 42. 1830. Plants polygamo-dioecious. Spikelets in deciduous clusters of threes, almost sessile along the continuous rachis of a simple spike; lateral spikelets 1- to 2-, the central 2- to 4-flowered, flowers hermaphrodite. Two lower glumes empty, unequal, mucronate or short-awned, the second glume of the central spikelet briefly 2-lobed, short-awned between lobes; flowering glumes longer, deeply 4-cleft, awned between the hyaline divisions. Palea shorter than the glumes, briefly 2- to 3-dentate at apex. Stamens 3. Styles distinct; stigmas plumose (really aspergilliform). A cæspitose grass extensively creeping by stolons, sending up from the rooting nodes leafy tufts of erect flowering branches.

Species 1, in Mexico, extending into western Texas.

FIG. 89. **Scleropogon brevifolius** Philippi.—*a*, A staminate or male spikelet; *b*, a male floret; *c*, dorsal view of a fertile flowering glume, the long awns removed; *d*, the pistil.

89. **SCLEROPOGON** Philippi, Sert. Mendoc. **2** : 47. 1871. Spikelets unisexual, the staminate and pistillate unlike, 2- to many-flowered. Staminate spikelets many-flowered; glumes narrow, acute, 3-nerved, awnless, the two lower empty, unequal, somewhat smaller than the floral glumes; flowering glumes sometimes minutely 3-dentate at apex. Palea narrow, rigid, nearly equaling the glume, 2-carinate, 2-dentate. Stamens 3; ovary rudimentary. Pistillate spikelets 1- to many-flowered, sterile above; 2 lower glumes empty, persistent, very unequal, larger than in the staminate spikelets; flowering glumes rigid, narrow, convolute about the flower, the three nerves produced into very long, slender, divergent, and somewhat twisted awns; uppermost sterile glumes like the flowering glumes, but thinner or reduced to slender awns. Palea rather rigid, very narrow, inclosed by the flowering glume. Staminodia none. Styles distinct, elongated; stigmas subplumose, with short hairs. Caryopsis narrow, elongated, included in the glume, free. Perennial, cæspitose or repent grasses, branched at base or stoloniferous. Panicle nearly simple, with short branches.

Species 1, southern Colorado southward to Chile.

FIG. 90. **Monanthochloë littoralis** Engelm. SALT CEDAR.—*a*, A branch containing spikelets concealed in the crowded leaf-sheaths.

90. **MONANTHOCHLOË** Engelm. Trans. St. Louis Acad. sci. I: 436. 1859. Spikelets 2- to 3-flowered, unisexual, somewhat unlike, usually sessile in pairs, and concealed within the leaf fascicles, the upper floral leaves becoming smaller, at length reduced to the sheaths, and resembling the outer empty glumes; flowering glumes membranaceous, rigid, obtuse, or denticulate. Palea 2-nerved, inclosed within the flowering glume. Stamens in the male florets 3. Styles in the pistillate florets distinct, elongated, with long barbellate stigmas. Grain free within the fruiting glume and palea. A creeping or stoloniferous grass, with short, rigid, crowded leaves.

Species 1, American.

FIG. 91. **Munroa squarrosa** (Nutt.) Torr. FALSE BUFFALO-GRASS.—*a*, A spikelet; *b*, the outer empty glumes; *c*, a floret.

91. **MUNROA** Torr. Pac. R. R. Rept. **4**[5] : 158. 1857. Spikelets 2- to 4-flowered, hermaphrodite, 3 to 5 together, and nearly sessile in the axis of the floral leaves. Rachilla articulated above the empty glumes. Lower empty glumes 2, lanceolate, acute, hyaline, 1-nerved; flowering glumes larger than the empty ones, 3-nerved, entire, retuse, or 3-cleft, the midnerve, or all the nerves excurrent as short mucronate points. Usually 1 or 2 empty glumes above the flowering glumes, similar to these, excepting that they are smaller and narrower. Palea hyaline, 2-keeled, inclosed within the flowering glume. Stamens 3. Styles distinct, elongated; stigmas loosely and shortly plumose, barbellate. Grain inclosed within the fruiting glume and palea, free. Low, diffusely much-branched annuals with short, usually sharp-pointed leaves, which are clustered at the ends of the branches.

Species 3 or 4, on the plains of North and South America.

FIG. 92. **Orcuttia californica** Vasey.—*a*, A spikelet showing the lower empty glumes, a portion of the rachilla, and a number of the upper florets; *b*, a portion of a spikelet; *c*, dorsal view of the expanded flowering glume; *d*, palea. Fig. 503, Bul. 17, illustrates another grass referred to this genus.

92. **ORCUTTIA** Vasey, Bul. Torr. Bot. Club **13** : 219, *pl. 16*. 1886. Spikelets many-flowered, compressed, sessile, crowded in short terminal spikes, the lowermost spikelet often remote; rachilla articulated above the empty glumes and between the florets. Two lower glumes empty, nearly equal, broadly lanceolate, irregularly 2- to 5 -toothed, shorter than the flowering glume; flowering glumes oblong, many-nerved, 5-toothed or 5-cleft at the broad apex, the principal nerves extending into the divisions. Palea 2-nerved, 2-keeled, about as long as the flowering glumes. Stamens 3. Styles long, distinct; stigmas short, plumose. Grain free within the glumes. Low cæspitose annuals, with short leaves and rather large many-flowered spikelets.

Species 2, Southern and Lower California.

FIG. 93. **Gynerium argenteum Nees.**—*a*, The empty glumes of a pistillate spikelet; *b*, a pistillate spikelet, the empty glumes removed; *c*, the empty glumes of a staminate spikelet; *d*, a staminate spikelet, empty glumes removed.

93. **GYNERIUM** H. B. K. Plant. Equin. **2** : 112, *t.* 115. 1809. Spikelets loosely 2- to many-flowered, dioecious; rachilla articulated above the empty glumes, usually long-pilose, at least in the fertile spikelets. Empty glumes 2, narrow and very long, acuminate-pointed; flowering glumes very narrow, produced into long subulate points, the back and margins clothed with long silky hairs; flowering glumes in the staminate spikelets usually smooth. Tall, reed-like, perennial grasses, with solid culms and very long, narrow leaves, which are chiefly from the base, and ample, showy, **terminal panicles**.

Species 3, in the warmer regions of South America; one introduced into the United States and cultivated for ornament under the name of Pampas grass.

FIG. 94. **Arundo donax** L.—*a*, A spikelet; *b*, a floret.

94. **ARUNDO** Linn. Sp. Pl. 120. 1753. Spikelets 2- to many-flowered; rachilla articulated above the empty glumes and between the florets, smooth; florets crowded, hermaphrodite, or the upper or lower staminate; empty glumes 2, narrow, a little unequal, 3-nerved, smooth, acute, or acuminate, about the length of the spikelet; flowering glumes thin, membranaceous, 3-nerved, 2-toothed at the apex, and mucronate between the teeth, long-pilose on the back. **Palea hyaline, 2-keeled**, shorter than its glume. **Grain smooth, inclosed** within the palea and glume, but free. Tall and reed-like grasses, with hollow culms, broad, flat leaves and ample terminal panicles.

Species 6 or 7, distributed throughout the warmer countries of the world; one, the species here illustrated, introduced and cultivated for ornament.

FIG. 95. **Phragmites vulgaris** (Lam.) B. S. P. (*P. communis* Trin.) COMMON REED.—*a*, A spikelet; *b*, the outer empty glumes; *c*, a single floret showing palea, stamens, and stigmas.

95. **PHRAGMITES** Trin. Fund. Agrost. 134. 1820. Spikelets loosely 3- to 7-flowered; rachilla articulated above the empty glumes and between the florets, clothed with long, silky hairs. The lowest floret staminate or neuter, those above hermaphrodite; empty glumes unequal, lanceolate, acute, shorter than the florets; flowering glume glabrous, very narrow and long acuminate pointed, much exceeding the short palea. Grain free. Tall, reed-like perennial grasses with stout leafy culms and large terminal panicles.

Species 2 or 3, 1 cosmopolitan, 1 in Asia, and 1 in South America.

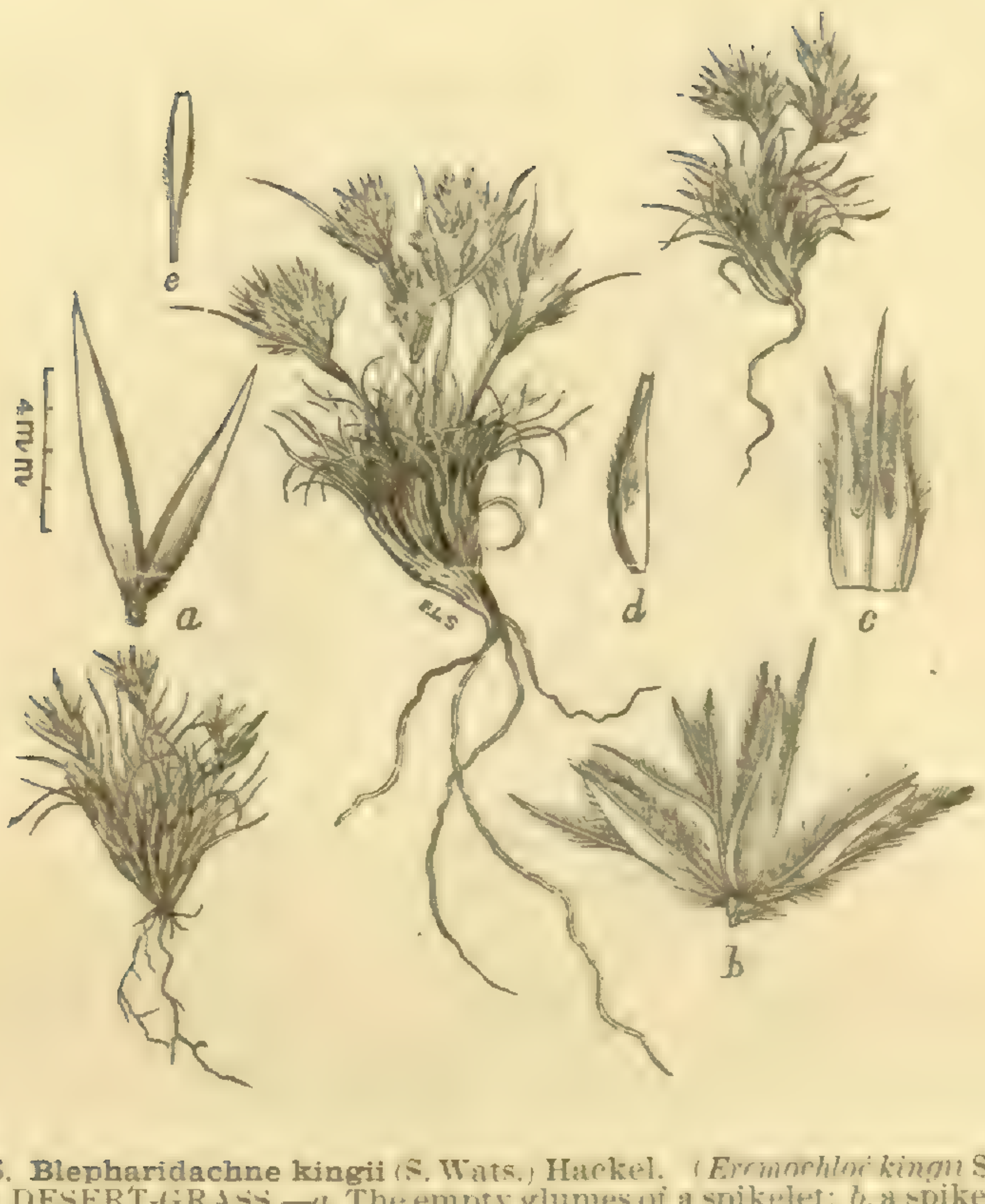

FIG. 96. **Blepharidachne kingii** (S. Wats.) Hackel. (*Eremochloë kingii* S. Wats.) KING'S DESERT-GRASS.—*a*, The empty glumes of a spikelet; *b*, a spikelet with the empty glumes removed; *c*, flowering glume; *d* and *e*, palea.

96. **BLEPHARIDACHNE** Hack. in Engl. & Prantl. Pflanzenfamilien 2^2: 126. 1887. Spikelets with 1 hermaphrodite flower. Lower empty glumes 4, the 1st pair membranaceous, acute, slightly unequal, 1-nerved; the 2d pair 3-nerved, 3-lobed, the middle division aristiform; the fertile glume strongly compressed, 3-nerved, 3-cleft, the nerves produced into slender awns, which are more or less plumose; the terminal floret reduced to an empty glume or 3 awns. Stamens 3. Styles distinct; stigmas plumose. Grain terete or slightly compressed on the back, included within the fruiting glume and palea, free. Low, densely cæspitose, perennial grasses with crowded, rigid leaves, and small, terminal densely-flowered panicles.

Species 2, in the desert regions of **Nevada and Arizona**.

FIG. 97. **Triodia eragrostoides** Vasey & Scribn.—*a*, A spikelet; *b*, the same with the empty glumes separated from the florets *c*, above; *d*, dorsal view of a flowering glume, *e*, palea. Figs. 231 to 236, in Bul. 7, and 505 to 507, in Bul. 17, illustrate other species of this genus.

97. **TRIODIA** R. Br. Prod. Fl. Nov. Holl., 182. 1810. Spikelets 3- to 12-flowered, nearly terete, in strict or open panicles; rachilla articulated between the florets, smooth or short-pilose; florets hermaphrodite or the uppermost staminate. Empty glumes 2, unequal, somewhat keeled, shorter than the spikelet; flowering glume membranaceous or subcoriaceous, rounded on the back at least below, 3-nerved, 2- to 3-toothed or pointed; nerves, especially the marginal, silky-villous below and extending (in our species) between the teeth at the apex into 3 mucronate points. Palea broad, concave, with 2 nearly marginal nerves. Stamens 3. Styles short, stigmas plumose. Grain free. Perennial grasses with narrow leaves and variable habit.

Species about 25, widely distributed throughout the temperate zones, with a few in tropical America. Nearly half the entire number of species occur in the United States, chiefly Texas and the Southwestern Territories.

FIG. 98. **Sieglingia decumbens** Bernh. (*Triodia decumbens* Beauv.) HEATHER-GRASS.—*a*, A single spikelet; *b*, a floret; *c*, the dorsal view of a flowering glume.

98. **SIEGLINGIA** Bernh. Syst. Verz. Pfl. Erfurt. 40. 1800. Spikelets 3- to 5-flowered. Empty glumes 2, acute, the 1st 3- the 2d 5-nerved, subequal; flowering glume obtusely 3-toothed, 5-nerved, ciliate on the margins below. Palea shorter than its glume. Stamens 3. Styles distinct; stigmas plumose. Grain free. A densely caespitose perennial, with narrow, flat leaves and small, terminal, simple panicles.

Species 1, Northern Europe and Asia, and Newfoundland, where it has probably been introduced.

FIG. 99. **Triplasis americana** Beauv.—*a*, A spikelet; *b*, a joint of the rachilla and floret, showing the palea. Fig. 509 in Bul. 17 illustrates a second species of this genus.

99. **TRIPLASIS** Beauv. Agrost. 81. *t. 16, f. 10.* 1812. (*Diplocea* Rafin. 1819. Spikelets many-flowered; flowers hermaphrodite or the uppermost staminate. Empty glumes 2, carinate, acute, awnless, shorter than the others; flowering glumes distichous along the rachilla, rounded on the back at the base, deeply 3-lobed, lobes smooth or ciliate, sides narrow, very acute, almost produced into awns, the middle longer, aristiform, often subflexuous-spreading. Palea shorter, broad, compressed, 2-keeled, keels long-ciliate. Stamens 3. Styles short, distinct; stigmas plumose. Perennial grasses, with very narrow leaves, convolute or flat at the base; and slender simple panicles; spikelets shortly pedicellate, usually erect.

Species 2, North American.

FIG. 100. **Redfieldia flexuosa** Vasey. REDFIELD'S GRASS.—*a*, A spikelet; *b*, a floret; *c*, a flower.

100. **REDFIELDIA** Vasey, Bul. Torr. Bot. Club, **14** : 133. 1887. Spikelets 1- to 6- flowered, hermaphrodite (the uppermost usually staminate), awnless; rachilla articulated above the empty glumes, its internodes very short. Empty glumes 2, nearly equal, 1-nerved, shorter than the flowering glume; flowering glumes 3-nerved, chartaceous, indistinctly 3-toothed at the apex, or terminating in a short mucronate point, hairy at the base. Palea 2-nerved, usually shorter than its glume. Styles long, distinct; stigmas short, plumose. Grain oblong, terete, free. A rather tall perennial, with long, narrow leaves and ample, diffuse panicles.

Species 1, on the sandy plains of the interior.

FIG. 101. **Dissanthelium californicum** Benth.—*a*, The outer empty glumes; *b*, a spikelet of 3 florets with the empty glumes removed.

101. **DISSANTHELIUM** Trin. Linnæa, 10 : 305. 1836. **Spikelets hermaphrodite, 2- to 4-flowered;** rachilla articulated above the empty glumes and between the florets, and produced beyond the flowers into a minute stipe. Outer empty glumes 2, persistent, narrow, 1- to 3-nerved, acute, slightly unequal, equaling or exceeding the spikelet; flowering glumes much shorter than the empty ones, **broader, obtuse, awnless, subcarinate, 3-nerved, lateral nerves nearly marginal.** Palea a little shorter than the glume, 2-keeled, 2-toothed. Stamens 3. Styles very short, distinct; stigmas rather long, loosely plumose. Grain oblong, free. **Low annual or perennial,** slender grasses, with narrow flat leaves and loosely **or densely flowered** terminal panicles.

Species 3, one in California, and the others Mexican or South American.

FIG. 102. **Molinia cærulea** Moench. (*Enodium cæruleum* Gaud.) MOLINIA.—*a*, The outer empty glumes of a spikelet; *b*, a spikelet of 2 florets with the empty glumes removed.

102. **MOLINIA** Moench, Meth. 183. 1794. Spikelets 2- to 4-flowered, hermaphrodite, or the uppermost imperfect; rachilla articulated above the empty glumes and between the florets; empty glumes at the base of the spikelet 2, nearly equal, shorter than the flowering glumes, convex on the back, 1-nerved; flowering glumes cartilaginous, acute, awnless, rounded on the back, and with 3 (rarely 4) prominent nerves. Palea a little shorter than the glume, obtuse, 2-nerved. Stamens 3. Styles short, distinct; stigmas plumose. Grain oblong, inclosed within the fruiting glume and palea, free. **A rather tall, cæspitose, perennial grass, with narrow flat leaves, and an elongated, narrow panicle of rather small, erect spikelets.**

Species 1, European. Sparingly introduced in the Eastern States.

FIG. 103. **Eragrostis pectinacea** (Michx.) Steud.—*a*, A spikelet; *b*, a 3-flowered spikelet; *c*, a portion of a spikelet showing the persistent paleas below. Figs. 240 to 250, in Bul. 7, and 511 to 516, in Bul. 17, illustrate other species of *Eragrostis*.

103. **ERAGROSTIS** Beauv. Agrost. 70. 1812. Spikelets 2- to many-flowered, the uppermost flower imperfect; rachilla articulated but sometimes not breaking up until after the fall of the fruiting glumes. Empty glumes 2, more or less unequal, usually shorter than the floral glumes; flowering glumes glabrous, obtuse, or acute, awnless, 3-nerved, lateral nerves sometimes very faint. Paleas shorter than their glumes, often persistent after the fall of the fruiting glume, 2-nerved, nerves prominent. Annual or perennial grasses with herbaceous stems, of various habit from 2 to 4 inches to as many feet tall, much branched, or with simple culms. Allied to *Poa*, but with 3-nerved flowering glumes, which are destitute of any wooliness. The species are very variable and their limits hard to define.

Species about 100, in warm and temperate regions of both hemispheres.

FIG. 104. **Eatonia pennsylvanica** (DC.) A. Gray. EATON'S-GRASS.—*a*, A spikelet: *b*, the empty glumes which have been separated from the three florets above, *c*. Figs. 252 to 254 illustrate other species of this genus.

104. **EATONIA** Rafin. Journ. Phys. **89** : 104. 1819. Spikelets 2- to 3-flowered; rachilla articulated above the empty glumes and between the florets and produced above the upper flower into a slender, **naked bristle. Empty glumes 2, a** little shorter than the florets, the 1st very narrow or linear and 1-nerved, the 2d broadly obovate, 3-nerved, with rather broad, scarious margins; flowering glumes obtuse and usually awnless, the 2d floret sometimes short-awned from the apex. Palea narrow, 2-nerved. Styles distinct, short; stigmas plumose. Grain narrow, free. Rather slender tufted perennials, with usually flat leaves **and narrow but often lax, terminal, many-flowered panicles.**

Species 4 all natives of the Eastern United States, two extending westward to the Rocky Mountains.

FIG. 105. **Koeleria cristata** Pers.—*a*, A spikelet; *b*, a spikelet expanded

105. **KOELERIA** Pers. Syn. 1: 97. 1805. Spikelets 2- to 4-flowered, compressed; rachilla articulated above the empty glumes. Empty glumes 2, unequal, keeled, somewhat shorter than the flowering glumes: flowering glumes membranaceous, more or less scarious, faintly 3- to 5-nerved, obtuse, acute or mucronate-pointed. Palea hyaline, acute, 2-nerved, about as long as its glume. Stamens 3. Styles very short; stigmas plumose. Annual or perennial cæspitose grasses, with narrow, usually flat leaves, and densely flowered spikelike panicles.

Species about 12, in the temperate regions of both hemispheres.

FIG. 106. **Catabrosa aquatica** (L.) Beauv. WATER WHORL-GRASS.—*a*, A 2-flowered spikelet; *b*, a spikelet with 1 floret; *c*, the outer empty glumes; *d*, a single floret.

106. **CATABROSA** Beauv. Agrost. 97. 1812. Spikelets small, usually 2-flowered, hermaphrodite, with the rachilla articulated between the florets. Empty glumes 2, much shorter than the flowering glumes, unequal, scarious, very obtuse, or the upper crenulate at the apex: flowering glumes rather rigid or subcoriaceous, obtuse or 3-toothed at the apex, prominently 3-nerved, awnless: palea as long as the glumes, prominently 2-nerved. Stamens 3. Styles distinct: stigmas plumose. A creeping aquatic grass, with flat leaves, and open pyramidal panicles on ascending branches.

Species 1, in the cooler regions of Europe, Asia, and North America.

FIG. 107. **Melica mutica** Walt. (*M. glabra* MX.).—*a*, A spikelet; *b*, a palea; *c*, 2 stamens. Figures 258 to 261, in Bul. 7, and 518 to 528, in Bul. 17, illustrate other species of *Melica*.

107. **MELICA** Linn. Sp. Pl. 66. 1753. Spikelets 2- to several-flowered, terete or slightly flattened; rachilla articulated above the empty glumes and between the fertile florets, usually bearing 2 or 3 empty, often club-shaped or cucullate glumes at the apex. Empty glumes at the base of the spikelet 2, unequal, membranaceous, awnless, 3- to 5-nerved; flowering glumes larger, rounded on the back, 7- to 13-nerved, margins **scarious, awnless or short-awned. Palea** broad, 2-keeled, shorter than the glume. Stamens 3. **Styles distinct; stigmas plumose.** Grain free. Perennials, with usually soft, flat leaves, rather large spikelets in lax or dense, usually narrow panicles, sometimes simply racemose.

Species 30 or more throughout the temperate zone. Some 18 species belong to the United States, chiefly in the Rocky Mountain and Pacific Coast regions.

FIG. 108. **Anthochloa colusana** (Davy) Scribner. (*Neostapfia colusana* Davy).—*a*, A single spikelet; *a'*, another view of the same; *b*, a single floret; *c*, flowering glume; *d*, palea.

108. **ANTHOCHLOA** Nees in Lindl. Introd. Nat. Syst. Bot. ed. **2** : 450. 1836. Spikelets several-flowered; flowers hermaphrodite. Empty glumes small or wanting, awnless; flowering glumes thin-membranaceous, very broad and flabelli-form or petal-like, sub-3–5- or many-nerved. Palea narrower than the glume, 3–4-cleft, hyaline. Stamens 3. Styles 2, distinct, short; stigma plumose. Low cæspitose grasses with flat leaves and invaginate or shortly exserted capitate or cylindrical panicles.

Species 3, two in Andes of Bolivia and Peru, one in California.

FIG. 109. **Korycarpus diandrus** (Michx.) Kuntze. (*Diarrhena americana* Beauv.).—*a*, A spikelet; *b*, the outer empty glumes of the same; *c*, a floret; *d*, the pistil and lodicules.

109. **KORYCARPUS** Zea, Act. Matrit. 1806. (*Diarrhena* Beauv. 1812.) Spikelets 3- to 5-flowered; rachilla articulated above the empty glumes and between the florets; lower florets perfect, the uppermost 1 or 2 sterile. Empty glumes unequal, ovate, awnless, shorter than the florets; flowering glumes broader, subcoriaceous, rounded on the back, smooth and shining, 3-nerved, acuminate or mucronate-pointed. Palea rather broad 2-keeled. Stamens 2, or rarely only 1. Styles short, distinct; stigmas plumose. Grain large, usually exceeding the palea and glume, obliquely ovoid and obtusely pointed.

Nearly smooth perennials with simple culms from a creeping rootstock, flat leaves and few-flowered terminal panicles.

Species 2, one in Japan, the other in Eastern North America.

FIG. 110. **Pleuropogon sabinii** R. Br.—*a*, Empty glumes; *b*, spikelet with the empty glumes removed; *c*, palea; *d*, flower.

110. **PLEUROPOGON** R. Br. Suppl. App. Parry's Voy. 289. 1823. Spikelets 8- to 15-flowered; hermaphrodite; rachilla articulated above the empty glumes and between the florets. Empty glumes at the base of the spikelet 2, membranaceous or subhyaline, 1-nerved, or the 2d imperfectly 3-nerved, awnless, unequal; flowering glumes longer than the empty ones, membranaceous or cartilaginous, 7-nerved, entire, or somewhat 2-toothed at the apex, with the midnerve extending into a short mucro or awn. Palea a little shorter than the glume, hyaline, 2-nerved, 2-keeled; the keels winged. Stamens 3. Styles short; stigmas plumose. Grain free within the glumes. Soft, erect, annual or perennial grasses, with flat leaves, and rather large spikelets in terminal racemes.

Species 3, two in the United States and one in the Arctic regions.

FIG. 111. **Uniola latifolia** Mx. BROAD-LEAFED SPIKE-GRASS.—*a*, A spikelet; *b*, the 3 lower empty glumes, *c*, a flowering glume; *d*, the palea. Figs. 265 and 266, in Bul. 7, and 530 and 531, in Bul. 17, illustrate other species of *Uniola*.

111. **UNIOLA** Linn. Sp. Pl. 71. 1753. Spikelets 3- to many-flowered; rachilla articulated above the empty glumes and between the **florets**. Empty glumes at the base of the spikelet 3 to 8, compressed-keeled, acute, unequal; flowering **glumes firm-membranaceous**, compressed-keeled, acute, or acuminate-pointed, striate, many-nerved. Palea rigid, 2-keeled. Stamens 1 to 3. Styles distinct, stigmas **plumose**. **Grain compressed**, oblong, free. Erect perennials, with simple culms, broad and flat or narrow and involute leaves, and narrow and few-flowered or ample, lax, and many-flowered panicles.

Species 4 to 5, all North American.

FIG. 112. **Distichlis spicata** (L.) Greene. ALKALI-GRASS.—*a*, A staminate spikelet; *b*, flowering glume; *c*, palea; *d*, a pistillate spikelet; *e*, flowering glume from a floret of the same; *f*, palea from same. Fig. 532 in Bul. 17 illustrates another species of *Distichlis*.

112. **DISTICHLIS** Raf. Journ. Phys. **89** : 104. 1819. Spikelets 8- to 16-flowered, dioecious. Empty glumes at the base of the spikelets 2, carinate, acute, shorter than the flowering glumes; flowering glumes broader, 3- to many-nerved, acute, rigid, membranaceous or subcoriaceous. Palea 2-keeled, equaling or a little shorter than the glumes. Stamens in the male flower 3. Styles in the pistillate flowers thickened at the base, rather long, distinct; **stigmas plumose, protruding** from the apex of the floret. Grain closely enveloped in the thickened and coriaceous base of the palea. Spikelets usually more numerous in the staminate than in the pistillate plants, and less crowded. Rather rigid, erect grasses, springing from a decumbent or creeping base, with dense panicles of rather few, **large and usually compressed spikelets.**

Species 4 or 5, along the coast and on the alkaline plains in extra tropical North and South America, one of which extends to Australia.

FIG. 113. **Briza media** L. QUAKING-GRASS.—*a*, A spikelet; *b*, a flowering glume; *c*, a palea.

113. **BRIZA** Linn. Sp. Pl. 70. 1753. Spikelets many-flowered, rounded-ovate, or heart-shaped; rachilla articulated above the empty glumes and between the florets; florets crowded, the uppermost usually imperfect. Glumes membranaceous, with broad, scarious margins, strongly concave, rounded on the back, and more or less ventricose; empty glumes 2, subequal, shorter than the florets; floral glumes 3 to many-nerved, cordate at the base, awnless; palea much smaller than its glume, obtuse, 2-keeled. Stamens 3. Styles short, distinct; stigmas plumose. Annuals or perennials, with flat or convolute leaves, loosely-flowered and open, or narrow and spike-like panicles.

Species 12, in Europe, North Africa, and the temperate regions of South America, extending north into Mexico.

FIG. 114. **Dactylis glomerata** L. ORCHARD-GRASS.—*a*, A spikelet in flower; *b*, a single floret; *c*, a flower with 3 stamens and 2 plumose stigmas; *d*, the upper portion of a leaf-sheath and lower part of the leaf-blade showing the ligule at the point where these parts join; *e*, a section of the culm at one of the nodes.

114. **DACTYLIS** Linn. Sp. Pl. 71. 1753. Spikelets 3- to 5-flowered, nearly sessile in dense fascicles; rachilla articulated above the empty glumes and between the florets. Empty glumes unequal, 1- to 3-nerved, sharply keeled, acute; floral glumes 5-nerved, short-awn-pointed, strongly compressed-keeled, keel conspicuously ciliate-fringed. Palea a little shorter than the glumes, 2-keeled. Stamens, 3. Styles distinct; stigmas plumose. Grain, narrow, oblong, inclosed within the fruiting glume and palea, but free. A perennial grass with flat leaves and narrow (expanded in flower) glomerate panicles.

Species 1, with several varieties, native of the north temperate regions of the Old World, but now very widely distributed in cultivation and has become thoroughly naturalized in many parts of the United States.

FIG. 115. **Cynosurus cristatus** L. DOG'S-TAIL-GRASS.—*a*, A spikelet in flower; *b*, the same showing only stigmas; *c*, a sterile spikelet composed of empty glumes.

115. **CYNOSURUS** Linn. Sp. Pl. 71. 1753. Spikelets of two forms in small fascicles, these forming a dense, somewhat unilateral spike-like panicle; terminal spikelets of the fascicles 2- to 4-flowered, hermaphrodite, the lower spikelets sterile, consisting of many empty glumes; rachilla of the fertile spikelet articulated. Empty glumes 2, narrowly lanceolate, acute; flowering glumes broader, membranous, 1- to 3-nerved, mucronate or awn-pointed. Glumes of the sterile spikelet distichous, spreading, subequal, linear, 1-nerved; rachilla not articulated. Stamens 3. Styles distinct, short; stigmas loosely plumose. Grain oblong, finally adherent to the palea. Annual or perennial, cæspitose grasses, with flat leaves.

Species 4 or 5, in the north temperate regions of the Old World. One introduced and sparingly naturalized in the United States.

FIG. 116. **Lamarckia aurea** (L.) Moench. GOLDEN-TOP.—*a*, A sterile spikelet; *b*, the 1-flowered fertile spikelet; *c*, pistil.

116. **LAMARCKIA** Moench, Meth. 201. 1794. Spikelets of two forms; fasciculate; the terminal one of each fascicle fertile, the others (1 to 3) below, linear, and consisting of many distichously imbricated obtuse empty glumes. Fertile spikelet 1-flowered, with the rachilla prolonged into a slender stipe, and bearing a small empty awned glume or reduced wholly to an awn. Lower empty glumes 2, **1-nerved, acuminate or short-awned, slightly unequal; flowering** glume broader, 1-nerved, bearing just below the apex a slender straight awn. Palea narrow, 2-keeled. Stamens 3. Styles short, distinct; stigmas elongated, barbellate. A low annual grass 1–3 dm (4′–12′) high, with flat leaves, and elegant one-sided panicles of crowded fasciculate spikelets, the fertile spikelets being almost wholly concealed by the more numerous sterile ones.

Species 1. Southern Europe and Southwestern Asia. Introduced and apparently spontaneous in Southern California. A very attractive and favorite ornamental grass.

FIG. 117. **Poa pratensis** L. KENTUCKY BLUE-GRASS.—*a*, A spikelet; *b*, a single floret from the same, showing the long cobwebby hairs at the base. Figs. 271 to 278, in Bul. 7, and 533 to 562, in Bul. 17, illustrate other species of the genus *Poa*.

117. **POA** Linn. Sp. Pl. 67. 1753. Spikelets 2- to 6-flowered, the uppermost flower imperfect or rudimentary; rachilla articulated above the empty glumes. Empty glumes herbaceous, lanceolate or ovate, 1- to 3-nerved, keeled, persistent; flowering glumes herbaceous or membranaceous, lanceolate or ovate, acute or obtuse, awnless, 5-nerved, carinate, falling with the 2-keeled palea and a joint of the rachilla, the dorsal or marginal nerves usually soft-hairy, and often with a tuft of long cobwebby hairs at the base. Stamens 3. Styles distinct; stigmas plumose. Inflorescence paniculate, the branches more or less spreading.

Species about 120 in both hemispheres, chiefly in the temperate and cooler regions and high mountains of the tropics. North American species, about 70.

FIG. 118. **Colpodium pendulinum** (Laest.) Griseb. **NODDING COLPODIUM.**—*a*, A 5-flowered spikelet; *b*, a single floret. **Fig. 564 in Bul. 17 illustrates a second species of *Colpodium*.**

118. **COLPODIUM** Trin. Fund. Agrost. 119. 1820. Spikelets 1, 2, rarely 3-flowered. Empty glumes 1-nerved or nerveless, thin membranaceous or hyaline, awnless; flowering glume thin membranaceous, broad, very obtuse, 5-nerved, the nerves obscure. Palea a little shorter than the 1st glume, hyaline, 2-nerved. Stamens 3. Styles short, distinct; stigmas plumose. Grain oblong, exsulcate free, within the palea. Slender annuals or biennials with narrow, sometimes setaceous leaves and slender, diffuse, usually capillary panicles with small spikelets.

Species 10 or 12, in central and eastern Asia, northern Europe, and Arctic America.

FIG. 119. **Dupontia psilosantha** Rupr. SLENDER DUPONTIA.—*a*, The outer empty glumes of the spikelet; *b*, three florets of the same. Fig. 566 of Bul. 17 illustrates another species of this genus.

119. **DUPONTIA** R. Br. Suppl. App. Parry's Voy. ccxc. 1823. Spikelets 2- to 5-flowered, hermaphrodite; rachilla articulated above the empty glumes, with the callus of the flowering glumes distinctly hairy. Empty glumes 2, membranaceous, awnless, longer than the flowering glume; flowering glumes entire, finely or minutely toothed at the apex, otherwise as in *Graphephorum*. Low grasses, with flat leaves, and usually narrow panicles.

Species 2, within the Arctic zone.

FIG. 120. **Scolochloa festucacea** (Willd.) Link. SPRANGLE-TOP.—*a*, The empty glumes of a spikelet, the florets of which are shown above at *b*.

120. **SCOLOCHLOA** Link, Hort. Berol. I : 136. 1827. Spikelets 3- to 4-flowered; rachilla articulated above the empty glumes; callus hairy; Empty glumes 2, acute, 3- to 5-nerved; flowering glumes rigid, rounded on the back, awnless, 5- to 7-nerved, nerves very unequal, one or more projecting beyond the apex of the glume. Ovary hairy at the top. Styles very short. Stigmas plumose. Tall grasses, with flat leaves, and ample, spreading panicles.

Species 2, in the north temperate zone of both hemispheres.

FIG. 121. **Graphephorum melicoideum** (Michx.) Beauv.—*a*, A 2-flowered spikelet showing the plumose prolongation of the rachilla above the 2d floret; *b*, the empty glumes; *c*, a single floret; *d*, apex of one of the flowering glumes.

121. **GRAPHEPHORUM** Desv. Nouv. Bul. Soc. Philom. **2**: 189. 1810. Spikelets 2- to 4-flowered, compressed; rachilla articulated above the empty glumes and between the florets, pilose, prolonged above the upper floret as a slender, hairy pedicel. Empty glumes 2, thin membranaceous, acute, keeled, about equaling the flowering glumes; flowering glumes thin membranaceous or scarious, faintly nerved, entire, awnless, or with a very short awn just below the apex. Stamens 3. Stigmas plumose. Ovary smooth. Slender, erect grasses, with flat leaves, and narrow, loose panicles.

Species 1 or 2, North American. (Allied to *Trisetum*.)

FIG. 122. **Panicularia aquatica** (Sm.) Kuntze. (*Glyceria aquatica* J. E. Smith). REED MEADOW-GRASS.—*a*, A spikelet; *b*, a spikelet in which the lower empty glumes have been separated from the florets above. Figs. 281 to 285, in Bul. 7, and 568 to 570, in Bul. 17, illustrate other species of *Panicularia*.

122. **PANICULARIA** Fabr. Enum. Pl. Hort. Helmst. 373. ed. 2. 1763. (*Glyceria* R. Br. 1810.) Spikelets few- to many-flowered, terete or slightly flattened, in narrow or spreading panicles; rachilla articulated between the florets, usually smooth; florets hermaphrodite or the uppermost imperfect. Empty glumes at the base of the spikelet 2, unequal, shorter than the flowering glumes, obtuse or acute, 1- to 3-nerved. Flowering glumes smooth or scabrous, rounded on the back, herbaceous, excepting at the scarious and usually blunt apex, 5- to 9-nerved, nerves usually prominent and parallel. Palea a little shorter than the glume, 2-nerved. Stamens 2 or 3. Styles short, distinct; stigmas plumose. Grain oblong, smooth, free, or when dry slightly adherent to the palea. Usually tall, aquatic, perennial grasses with flat leaves and generally diffuse terminal panicles.

Species about 16, widely dispersed in the temperate regions of both hemispheres, chiefly North American.

FIG. 123. **Puccinellia maritima** (Huds.) Parl. (*Glyceria maritima* M. & K.) SEA SPEAR-GRASS.—*a*, A 3-flowered spikelet; *b*, a 7-flowered spikelet; *c*, a single floret. Figs. 271 and 272 in Bul. 17 illustrate other species of *Puccinellia*.

123. **PUCCINELLIA** Parl. Fl. Ital. 1 : 366. 1848. *Atropis* Rupr. Fl. Samojed. 61. 1845. Spikelets as in *Panicularia*, but with the flowering glumes usually smaller, nerves less distinct or obscure, lodicules more hyaline and distinct.

Species 14, in northern extratropical regions of both hemispheres. Grasses chiefly confined to the seacoast or to the alkaline regions of the interior.

FIG. 124. **Festuca elatior pratensis** (Huds.) Hack. MEADOW FESCUE—*a*, A 7-flowered spikelet partly in flower. Other species of this genus are illustrated by figs. 287, 289, in Bul. 7, and 573 to 581, in Bul. 17.

124. **FESTUCA** Linn. Sp. Pl. 73. 1753. Spikelets several-flowered, pedicellate in narrow and dense or loose and spreading panicles; rachilla articulated above the empty glumes and between the florets. Empty glumes at the base of the spikelets 2, more or less unequal, narrow, **and acute; flowering glumes rounded** on the back at least below, acute (rarely obtuse) or tapering into a straight awn, faintly 3- to 5-nerved, not webbed at the base. Stamens 3. Styles very short, distinct; stigmas plumose. Grain elongated, furrowed, frequently adnate or grown to the palea or floral glume. Usually cæspitose, perennial (rarely annual) grasses of various habit.

Species about 80, in all parts of the world, especially the temperate regions. Many are valuable forage plants.

FIG. 125. **Bromus secalinus** L. CHESS OR CHEAT.—*a*, A 7-flowered spikelet. Other species of the genus *Bromus* are illustrated by Figs. 290 to 293 in Bul. 7, and 582 to 586, in Bul. 17.

125. **BROMUS** Linn. Sp. Pl. 1: 76. 1753. **Spikelets few- to many-flowered,** slightly or more rarely strongly flattened laterally in panicles, or rarely racemed; rachilla articulated above the empty glumes and between the florets, **florets hermaphrodite or the uppermost imperfect;** empty glumes at the base of the spikelet 2, unequal, acute, or the 2d short-awned, 1- to 5-nerved, shorter than the flowering glumes; **flowering glumes keeled or more often rounded** on the back, 5- to 9-nerved, usually 2-toothed at the apex, and awned from the back just below the point or from between the teeth, sometimes awnless; awn straight or divergent. Palea a little shorter than the glume, 2-keeled. Stamens usually 3. Stigmas plumose, sessile, springing from below the hairy cushion-like apex of the ovary. Grain furrowed and grown to the palea. Annual or perennial grasses with flat leaves and rather large erect or pendulous spikelets.

Species about 100, most abundant in the north temperate zone. There are about 35 species in the United States, including several introduced species.

Tribe XII.—HORDEÆ.

Spikelets 1- to many-flowered, usually hermaphrodite, sessile along the common rachis, forming a simple or compound spike;[1] glumes awned or awnless.

A small tribe of 20 genera and about 130 species. It is an important division, however, for it includes rye, barley, and the many varieties of wheat. English and Italian Rye-grasses (*Lolium* species) are the chief meadow grasses of the tribe.

KEY TO THE GENERA OF THE HORDEÆ.

1. Spikes slender, unilateral; spikelets 1-flowered, empty glume 1, very small and grown to the rachis ..... 126. Nardus
1. Spikes not unilateral 2
2. Spikelets solitary at each joint of the rachis 3
2. Spikelets 2 to 3 at each joint of the rachis 8
3. Spikes very slender; spikelets 1- or 2-flowered 4
3. Spikes stout; spikelets usually 2- or more-flowered 5
4. Flowering glume awned ..... 129. Scribneria
4. Flowering glume awnless ..... 128. Lepturus
5. Spikelets placed with one edge against the rachis; outer empty glume 1 (in the terminal spikelet 2) ..... 127. Lolium
5. Spikelets placed with their sides against the rachis; empty glumes 2 6
6. Flowering glumes with a distinct callus at the base, falling at maturity with the grain, which is adherent to the palea. 130. Agropyron
6. Flowering glumes without a distinct callus, persistent; grain free 7
7. Empty glumes subulate, 1-nerved ..... 131. Secale
7. Empty glumes lanceolate or ovate, 3- to many-nerved. 132. Triticum.
8. Spikelets 3 at each joint of the articulate rachis, 1-flowered, with a bristle-like prolongation of the rachilla behind the palea at least in the central spikelet ..... 133. Hordeum
8. Spikelets 2 at each joint of the rachis, with 2 or more hermaphrodite flowers 9
9. Empty glumes minute or none ..... 136. Asperella
9. Empty glumes usually equaling the flowering glumes 10
10. Axis of the spike continuous, rarely articulated; empty glumes entire ..... 134. Elymus
10. Axis of the spike articulated and readily breaking up; empty glumes usually 2- to many-parted or cleft ..... 135. Sitanion

[1] Strictly speaking, the spike is simple when the spikelets are 1-flowered, and compound when more than 1-flowered.

FIG. 126. **Nardus stricta** L. WIRE BENT.—*a*, The toothed axis of a spike; *b*, one of the spikelets; *c*, the same expanded in flower.

126. **NARDUS** Linn. Sp. Pl. 1 : 53. 1753. Spikelets 1-flowered, hermaphrodite. Empty glume 1, very small, and grown to the rachis, often indistinct; flowering glume acute or short-awned, the involute margins inclosing the 2-nerved palea. Stamens 3. Style simple, elongated; stigma barbellate, with short papillæ. A low, densely cespitose perennial with rather rigid setaceous basal leaves and a slender long-pedunculate spike-like unilateral inflorescence.

Species 1, Northern and Middle Europe, temperate Asia, Greenland and Newfoundland.

FIG. 127. **Lolium perenne** L. RYE-GRASS.—*a*, A portion of the axis of a spike to which is attached a spikelet with the lower florets expanded, showing the stamens; *b*, anterior view of a single floret; *c*, dorsal view of a floret. Fig. 296, in Bul. 7, and fig. 587, in Bul. 17, illustrate other species of *Lolium*.

127. **LOLIUM** Linn. Sp. Pl. 83. 1753. Spikelets several-flowered, solitary and sessile in alternate notches of the continuous rachis, one edge of each spikelet placed against the rachis; rachilla articulated between the florets. Empty glume at the base of the spikelet 1 (2 in the terminal spikelet), on the side away from the rachis (exterior), shorter than, or exceeding the florets; flowering glumes rounded on the back, 5- to 7-nerved, nerves converging above, apex obtuse, acute, or awned. Palea 2-keeled. Stamens 3. Styles very short, distinct; stigmas plumose. Grain smooth, adherent to the palea. Annual or perennial grasses, with simple erect culms, flat leaves and simple terminal spikes.

Species 6, in Europe, North America, and temperate Asia. Two, with several varieties, introduced into the United States.

FIG. 128. **Lepturus filiformis** (Roth) Trin. SLENDER HARD-GRASS.—*a*, A portion of a spike bearing 3 florets; *b*, a single floret; *c*, a flowering glume; *d*, palea; *e*, the lodicules. Fig. 589 in Bul. 17 illustrates another species of this genus.

128. **LEPTURUS** R. Br. Prodr. Fl. Nov. Holl. **I**: 207. 1810. Spikelets 1- to 2-flowered, solitary, sessile, alternate in excavations of the jointed rachis of the spike; rachilla very short, articulated above the empty glumes. Empty glumes 2, or rarely only 1, inclosing the flower, equal, hard or coriaceous, 5-nerved, acute, placed in front of the spikelet, except in the terminal one; flowering glumes much smaller than the empty ones, thin and hyaline, keeled. Palea 2-nerved, hyaline. Stamens 3 or fewer. Ovary smooth. Styles short, distinct; stigmas plumose. Caryopsis narrow, smooth, included within the glumes, free. Low annuals, or rarely tall perennials, with narrow, straight, or curved terminal spikes.

Species 5 or 6, widely distributed in the Eastern Hemisphere: 1 sparingly introduced into North America.

FIG. 129. **Scribneria bolanderi** (Thurb.) Hack.—*a*, *b*, spikelets; *c*, a floret showing the awned flowering glume, the palea, and one stamen; *c'*, the prolongation of the rachilla; *d*, palea; *e*, grain with adherent stamen at apex.

129. **SCRIBNERIA** Hack. Bot. Gaz. 13 : 105. 1888. Spikelets solitary or in pairs at the joints of the rachis, 1-flowered, hermaphrodite, with a very short prolongation of the rachilla behind the palea. Empty glumes 2, narrow, rigid, acute, slightly unequal, strongly keeled; flowering glume shorter than the empty ones, membranaceous, keeled, 2-toothed at the apex, and awned between the teeth; callus barbate. Palea as long as or slightly exceeding the glume, acutely 2-toothed. Stamens 1. Stigmas sessile, plumose. Caryopsis linear, nearly terrete. A low slender annual with short, narrow leaves and terminal, slender spikes.

Species 1, California, Oregon.

FIG. 130. **Agropyron tenerum** Vasey. SLENDER WHEAT-GRASS.—*a*, The empty glumes which enclose the four florets *b*.

130. **AGROPYRON** Gaertn. Nov. Comm. Acad. Sci. Petrop. **14**: 539. 1770. Spikelets 3- to many-flowered, closely sessile and single at each notch of the axis; rachilla articulated above the empty glumes under each flowering glume. Empty glumes 2, narrower and usually shorter than the floral glumes, acute or awned; flowering glumes rounded on the back, or slightly keeled above, 5- to 7-nerved, acute or awned from the apex, rarely obtuse. Palea 2-keeled, bristly-ciliate on the keels. Grain pubescent at the apex, usually adherent to the palea. Perennial grasses, with erect simple culms and terminal, often bearded spikes.

Species about 35, distributed throughout all temperate countries.

FIG. 131. **Secale cereale** L. RYE.—*a*, A spike with upper leaf; *b*, a spikelet; *c*, flowering glume, dorsal view; *f*, palea; *g*, grain.

131. **SECALE** Linn. Sp. Pl. 84. 1753. Spikelets usually 2-flowered, solitary and sessile at the alternate notches of the continuous rachis. Empty glumes rigid, very narrow, and subulate-pointed; flowering glumes broader, sharply keeled to the base, and **long-awned from the apex, 5-nerved.** Palea a little shorter than its glume, narrow, 2-keeled. Stamens 3. Styles very short, distinct; stigmas plumose. Grain oblong, subterete, sulcate on the anterior side, pilose at the apex, free within the fruiting glume. Annual, erect grasses with flat leaves and dense terminal spikes. In the cultivated forms the axis of the spike is usually continuous and not articulated.

Species 2, Southern Europe, Southern and Central Asia; one, *Secale cereale*, rye, is widely distributed in cultivation as a cereal.

FIG. 132. **Triticum vulgare** Vill. WHEAT:—*a*, A spikelet; *b*, a glume seen from the back; *c*, flowering glume seen from the side; *d*, palea; *e*, grain; *f*, a portion of the axis of the spike; *g*, pistil and lodicules.

132. **TRITICUM** Linn. Sp. Pl. 85. 1753. Spikelets 2- to 5-flowered, solitary at the notches of the main axis, forming a distichous spike. Empty glumes 2, **rigid, 3- to many-nerved, with 1 to many awns or abruptly toothed at the apex**: flowering glumes rounded on the back, or boat-shaped, many-nerved, terminating in one to several teeth or awns. Stamens 3. Styles very short; stigmas plumose. Grain flat or oblong, deeply sulcate-villous at the apex, free or adherent to the palea. Annual or biennial, erect grasses with flat leaves and terminal spikes.

Species 10 or 12, in Southern Europe and Western Asia; one species wheat, in its many varieties, is now widely cultivated throughout all temperate countries.

FIG. 133. **Hordeum boreale** Scribn. & Smith. NORTHERN WILD BARLEY.—*a*, A group of 3 spikelets, the lateral ones raised on short pedicels; *b*, the central floret; *c*, an expanded lateral floret. Other species of *Hordeum* are illustrated by figs. 603 to 610, in Bul. 17.

133. **HORDEUM** Linn. Sp. Pl. 84. 1753. Spikelets 1-flowered, 2 to 3 together at each joint of the articulate rachis, sessile or on very short pedicels; rachilla articulated above the empty glumes and continued behind the palea of the central spikelet into a naked bristle which sometimes bears the rudiment of a 2d floret. Empty glumes 2, narrow-lanceolate, subulate or setaceous, rigid, persistent; flowering glumes lanceolate, rounded on the back, obscurely 5-nerved above, usually awned; palea shorter than the glume, 2-keeled. Stamens 3. Styles very short, distinct. Ovary hairy at the top. Grain sulcate, adherent to the palea. Lateral spikelets usually imperfect and raised above the central one. Annual or perennial grasses, with terminal cylindrical spikes and awned spikelets.

Species about 16, in both hemispheres.

FIG. 134. **Elymus virginicus** Linn. TERRELL-GRASS.—One of the spikelets is shown below to the left. Other species of *Elymus* are illustrated by figs. 301, in Bul. 7, and 611 to 623, in Bul. 17.

134. **ELYMUS** Linn. Sp. Pl. 83. 1753. Spikelets 2- to 6-flowered, the uppermost imperfect, sessile, in pairs (rarely in 3s or 4s) at the alternate notches of the continuous or articulate rachis, forming terminal spikes; rachilla articulated above the empty glumes and between the florets. Empty glumes 2, nearly equal, rigid, narrow, 1- to 3-nerved, acute or awn-pointed, persistent, and subtending the florets like an involucre; flowering glumes shorter than the empty ones, rounded on the back, obscurely 5-nerved, obtuse, acute, or awned from the apex. Paleas a little shorter than the glumes, 2-keeled. Stamens 3. Styles short; stigmas plumose. Ovary hairy at the apex. Grain adherent to the glumes and paleas. Erect grasses with flat leaves and closely-flowered terminal spikes.

Species about 25, in the temperate regions of the Eastern and Western hemispheres. North American species about 20.

FIG. 135. **Sitanion glabrum** J. G. Smith. ORCHARD BARLEY.—*a*, A group of spikelets; *b*, one of the florets. Another species of the genus *Sitanion* is illustrated by fig. 624 in Bul. 17.

135. **SITANION** Rafin. Journ. Phys. **89** : 103. 1819. (*Egilops* Nutt., 1818, not Linn., 1737.) Spikelets usually 2, sometimes 3, or rarely only 1, at each joint of the articulate rachis of the spike, 2- to several-flowered. Empty glumes many-parted from near the base or merely bifid or subulate and entire, a 3d setaceous empty glume above the 2 outer ones is sometimes present, all awned; flowering glumes terminating in a single long awn, or trifid, and 3-awned. Palea as long as its glume, entire, bidentate or 2-awned. Stamens, pistil, and grain as in *Elymus*, from which genus *Sitanion* differs chiefly in its divided glumes and in the readiness with which the axis of the spike breaks up, in which latter character it resembles *Hordeum*. Cæspitose perennials, with usually flat leaves and bearded spikes.

Species about 25, in Western North America and Mexico.

FIG. 136. **Asperella hystrix** (L.) Humb. (*Elymus hystrix* Lin.; *Asperella* W.; *Gymnostichum hystrix* Schreb.). BOTTLE BRUSH.—*a*, A spikelet; *b*, a spikelet without empty glumes at the base. Another species of this genus is illustrated by fig. 626 in Bul. 17.

136. **ASPERELLA** Humb. in Roem. and Ust. Mag. Bot. 7 : 5. 1790. Spikelets 2- to 4-flowered, solitary or more often 2 to 3 together, raised on short, callus-like pedicels, at each joint of the continuous rachis; rachilla articulated below each flowering glume. Empty glumes 1 or 2, awn-like or bristle-form, usually present in the lower spikelets of each spike, much reduced or entirely wanting in the upper; flowering glumes narrow, rigid, smooth, and rounded on the back, long-awned from the apex. Palea strongly 2-keeled. Perennials with flat leaves and terminal, bearded spikes.

Species 4, two North American and two of limited range in the Old World.

Tribe XIII.—BAMBUSEÆ.

Spikelets 2- to many-flowered (rarely only 1-flowered) in racemes or panicles; empty glumes at the base of the spikelet two to several; flowering glumes many-nerved, awnless, or very rarely short-awned; culms woody, at least near the base, and perennial; leaf blade usually with a short petiole and articulated with the sheath from which it finally separates.

A comparatively small tribe of 23 genera and about 200 species. The species are chiefly confined to the region within the Tropics. Many of them are of very great importance to the natives of the countries where they grow. Manufactured articles of bamboo, either of use or for ornament, now enter into the commerce of the world. The bamboos are remarkable for their woody stems and often arborescent or tree-like habit of growth, some of the species attaining the height of 25 to 40 m. In parts of India they form extensive forests. One species in this tribe has leaves 2 to 5 m. long by 10 to 25 cm. wide; another, a Cuban species, has leaves 7 to 15 cm. long and as fine as a horse-hair. Fleshy and edible apple-like or berry-like fruits are borne by some of the species. In the East the bamboos furnish material for the construction of houses, household furniture, and domestic utensils, as well as for articles of ornament, and even clothing. Some supply drink to the thirsty traveler, and the highly farinaceous grain is used by the poorer casts for food. It is recorded that in India the fruit of bamboos have several times been the means of saving hundreds of thousands of people from stavation in times of famine. Many species are now in cultivation and are used for the decoration of parks and lawns. *Arundinaria macrosperma*, which forms the "canebrakes" of the Southern States, is our best known example of this tribe.

FIG. 137. **Arundinaria macrosperma** Michx. CANE.—*a*, A floret from one of the many-flowered spikelets; *b*, palea of same; *c*, the grain.

137. **ARUNDINARIA** Michx. Fl. Bor. Am. 1: 73. 1803. Spikelets 2- to many-flowered, large, laterally compressed, in racemes or panicles; the rachilla articulated above the empty glumes and between the florets; flowers hermaphrodite, or the upper imperfect. Lower empty glumes unequal, the 1st sometimes wanting; flowering glumes longer than the empty ones, keeled, many-nerved, acute, or mucronate-pointed. Paleas as long as the glumes, prominently 2-keeled. Lodicules 3. Stamens 3. Styles 2 or 3; stigmas plumose. Grain oval or narrowly oblong, furrowed. Tree-like or shrubby grasses, with perennial simple or branched culms, and flat leaves which are shortly petiolate and articulated with the sheaths.

Species, about 20, natives of Asia and America, 2 in the southern United States. Several eastern species have been introduced into gardens and cultivated for ornament.

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